DEEM ™

Dietary Exposure Evaluation Model

Users Manual

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Portions of this program use Microsoft Corporation's Visual Basic, QuickBasic®, Windows® and MS-DOS®.

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CHAPTER 1. INTRODUCTION TO DEEM™

DEEM™ is a dietary exposure analysis system that may be used to estimate exposure to constituents in foods comprising the diets of the US population, including population subgroups. The software was developed by Novigen Sciences, Inc. (Novigen) and contains food consumption data from the USDA Continuing Surveys of Food Intake by Individuals (CSFII) conducted in 1989 through 1992 and in 1994 through 1996. The food consumption data are translated into ingredients using Novigen's proprietary ingredient translation database. Novigen will continue to update the program as additional consumption data become available.

DEEM™ consists of four software modules: The main DEEM™ module, the Acute analysis module, the Chronic analysis module, and the RDFgen™ residue distribution module. The main DEEM™ module is used to create and edit residue files for specific chemical or cumulative applications, and to launch the DEEM™ Acute, Chronic, and RDFgen™ modules. The RDFgen™ module automates single analyte and cumulative residue distribution adjustments and the creation of summary statistics and Residue Distribution Files based up on USDA Pesticide Data Program (PDP) monitoring data or user-provided residue data. The Acute analysis and Chronic analysis modules provide dietary exposure assessment models based on USDA consumption data. The DEEM™ software itself is also integrated with CALENDEX™, an aggregate exposure assessment software application focusing on combined dietary and residential (non-dietary) exposures.

DEEM™ is a user-oriented, menu-driven system that runs on IBM personal computers and compatible microcomputers. It operates under Windows 95®, Windows 98®, and Windows NT 4®. To maximize application of the program and assure proper and complete use of data, we recommend that you read Chapter 4, *Guidelines for Conducting Dietary Exposure Assessments*. Chapter 3, *Validation of Program Installation/Operation*, provides the user with the tools to ensure that the programs have been installed correctly.

Appendix A contains the Listing of Foods, Food Forms and identifies the crop groups that are included in the programs. Appendix B contains some helpful suggestions and answers to frequently asked questions concerning the DEEM™ software and the USDA consumption data. Appendix C also contains helpful suggestions and information on simplifying data entry and conducting Monte Carlo analyses.

By using appropriate toxicological parameters associated with a chemical or constituent, the analyses generated by DEEM™ express risk as a function of dose through dietary exposure. To conduct either chronic or acute risk analyses using DEEM™ software the user must provide three types of information:

(1) concentrations of the constituent in the foods and/or food-forms. These can be a theoretical level such as the tolerance or MRL (maximum residue limit) or a level anticipated to be present in the food of interest. The acute program utilizes either a point estimate, a distribution of residues, or a combination of both.

(2) toxicological data on the constituent that are directly relevant to the evaluation of the significance of estimates of exposure by the oral route. These should include a toxicology endpoint based on chronic (long-term) exposure such as the cancer potency factor (Q_1*), Acceptable Daily Intake (ADI), chronic Population Adjusted Dose (cPAD) or other chronic Reference Dose (RfD). If acute exposures are to be evaluated, an acute toxicological endpoint such as the No Observed Effect Level (NOEL), acute Population Adjusted Dose (aPAD) or acute Reference Dose (aRfD) from a study in which animals were dosed for short periods of time will be required. The DEEM™ software will prompt the user for these values.

(3) adjustment factors directly relevant to potential constituent levels in the diet to more accurately reflect likely exposures. These adjustment factors can include percent of the crop treated, percent imported, impact of processing, etc.

DEEM™ expresses the potential risk relative to either the chronic or acute PAD, RfD (ADI) or NOEL (acute or chronic) selected by the user. It also is capable of expressing the exposure in relation to the results of cancer studies. The slope of the dose-response in cancer studies (called the Q_1*) is used to calculate a dose level relevant to a chosen probability value from a cancer study. Specifying the Q_1* will permit a determination of the probability for increased risk of cancer. In this case, the results will be an estimate of the relationship between the population's exposure and the probability of increased incidence of cancer.

As a crop item is processed into foods, the constituents may preferentially segregate into one fraction rather than be distributed equally into the various subparts of the item. For example, oil-soluble surface residues may remain in the peel. Thus, the residue level in peeled fruit may be lower than in the whole, unpeeled fruit. Similarly, the resulting concentration in peanut oil may be higher than the concentration in the whole peanut. To address this situation, DEEM™ multiplies each food consumption estimate by up to two "adjustment factors" designed to allow better matching of the residue data with food consumption data. For example, raisin consumption is expressed in terms of consumption of actual raisins. If chemical residue measurements were made on fresh grapes, an adjustment factor should be applied to account for the chemical concentration resulting from water loss. This adjustment factor will more accurately estimate potential exposure from residues in raisins. DEEM™ contains default adjustment factors to equate processed food consumption to equivalent fresh quantities. A second use of adjustment factors is to modify exposure estimates to reflect the percentage of a crop that is expected to contain residues (often called "percent crop treated"). A discussion of the default adjustment factors is provided in Chapter 5.

NOTE: In the manual, words in <X Y Z> indicate that a specific key should be pressed. For example, <Enter> indicates that the "Enter" key should be pressed; <Tab> indicates that the "Tab" key should be pressed.

CHAPTER 2. PROGRAM INSTALLATION

The DEEM™ computer programs and supporting data are supplied with this manual on one CD-ROM and one diskette. If licensed, the RDFgen™ module and Pre-extracted PDP data are supplied on three additional CD-ROMs. The DEEM™ program can be used on any computer system equipped with a Windows 95®, Windows 98®, or Windows NT 4® operating system, a CD-ROM drive, and a hard drive. Additionally, in order to use the RDFgen™ module, Microsoft Excel 97® must be properly installed on the computer system. Any compatible printer can be used to print DEEM™ analysis reports.

The display requirements for running the programs are:

> Desktop area 800 x 600 pixels, screen area also at 800 x 600 pixels (if separate setting is available), and small system fonts. To change setting, open "Control Panel" from the Windows® 95 environment, then open "Display," then select the "Settings" tab, then move Screen area (if available) and Desktop area to show "800 x 600." On the same screen, make sure that "Small Fonts" are selected under "Font size." Colors should be set to 256 or higher.

A Pentium®, Pentium II®, or Pentium III® processor is not required, but will significantly increase the speed of DEEM™ Acute analyses, which must read through and process daily food consumption records for many thousands of participants. A faster processor is especially useful if you are conducting Monte Carlo analyses with the DEEM™ Acute analysis module. Also, the larger the amount of memory available to DEEM™ (total system RAM, less memory utilized by other running applications), the faster the analyses will run.

2.1 INSTALLATION OF MAIN MODULES

The files on the DEEM™ CD-ROM(s) and diskette may be copied for archive purposes; however, this program is licensed for the designated site only. It is a violation of the US copyright law to copy the DEEM™ programs or any supporting files or to duplicate them on any media for resale or distribution to any user outside the limits of the contractual arrangements. Store the CD-ROM and diskette in a safe place.

To install DEEM™ (including the Residue File Editor and the Acute and Chronic analysis modules):

> **1)** Insert the CD-ROM labeled "DEEM™" into the CD-ROM drive. At the Windows® start menu, click on the "Run" option. Type
>
> ***E*:\setup**

where *E* is the drive letter of your CD-ROM drive (typically D or E). (Setup may request that you restart your computer and then manually initiate Setup for a second time. This is normal, and allows necessary system files to be updated.) At this point, the "DEEM Setup" window should appear. After reading the reminder to close open applications, click "OK". Click the large button in the "DEEM Setup" window to continue the installation (in doing so you are accepting the default installation path of **C:\Deem**). The installation program will finish; click "OK" in the confirmation dialog box.

2) Using Windows® Explorer or the DOS copy utility, copy all files from

***E*:\DEEM Supporting Files**

(where *E* is the drive letter of your CD-ROM drive) into the **C:\Deem** directory. **Overwrite any existing files if prompted.** Do not copy the "DEEM Supporting Files" folder itself; copy only its contents.

3) Using Windows® Explorer or the DOS copy utility, copy your company's license file (**Deem.cst**) as well as the setup file (**Setup96.fil**) into the **C:\Deem** directory. These two files can be found on the floppy diskette labeled "DEEM™ License Activation Files," or in the program directory of a previous installation of DEEM™.

4) The final step is to create the food consumption directory. Using Windows® Explorer, copy the entire

***E*:\NSIFood**

directory (where *E* is the drive letter of your CD-ROM drive), including the "NSIFood" folder itself, into **C:**. This will create a folder called

***C*:\NSIfood**

containing the **36 files** listed in Table 2.2. The path to this food consumption directory must be specified in the Setup module of DEEM™ (discussed in the following section) before you run any analyses.

For reference, Table 2.1 identifies the DEEM™ program and supporting files required in the C:\DEEM directory for a complete installation:

TABLE 2.1

DEEM™ PROGRAM AND SUPPORTING FILES

Deem.cst
Setup96.fil
Acute7.exe
Acuten.exe
CATNAM16.FIL
CATNAM96.NCG
Chronic7.exe
Convert96.exe
CROPGRP.RAN
deem.exe
FFORM92N.RAN
FFORMN.RAN
FFORMS96.RAN
FOODS92N.RAN
FOODS96.RAN
FOODSN.RAN
FOODST96.RAN
INDEX96.RAC
Mapallc.txt
MEAN96.RAN
MN8992N.RAN
MNFF396.RAN
MNFF92N.RAN
NFBW.RAN
Rdfdoc.exe

TABLE 2.2

FOOD CONSUMPTION FILES

ACUTE89N.1
ACUTE89N.2
ACUTE89N.3
ACUTE90N.1
ACUTE90N.2
ACUTE90N.3
ACUTE91N.1
ACUTE91N.2
ACUTE91N.3
ACUTE94.1
ACUTE94.2
ACUTE94.3
ACUTE95.1
ACUTE95.2
ACUTE95.3
ACUTE96.1
ACUTE96.2
ACUTE96.3
ACUTLN89.1
ACUTLN89.2
ACUTLN89.3
ACUTLN90.1
ACUTLN90.2
ACUTLN90.3
ACUTLN91.1
ACUTLN91.2
ACUTLN91.3
ACUTLN94.1
ACUTLN94.2
ACUTLN94.3
ACUTLN95.1
ACUTLN95.2
ACUTLN95.3
ACUTLN96.1
ACUTLN96.2
ACUTLN96.3

2.2 INSTALLATION OF RDFGEN™ MODULE WITH PRE-EXTRACTED PDP DATA

To install the RDFgen™ module:

Insert the CD-ROM labeled "RDFgen™" into the CD-ROM drive. At the Windows® start menu, click on the "Run" option. Type

***E*:\setup**

where *E* is the drive letter of your CD-ROM drive (typically D or E). (Setup may request that you restart your computer and then manually initiate Setup for a second time. This is normal, and allows necessary system files to be updated.) At this point, the "RDFgen Setup" window should appear. After reading the reminder to close open applications, click "OK". Click the large button in the "RDFgen Setup" window to continue the installation (in doing so you are accepting the default installation path of **C:\Program Files\Novigen\RDFgen**). The installation program will finish; click "OK" in the confirmation dialog box.

The RDFgen™ Input Generator Excel Add-in allows for automatic creation of RDFgen™ cumulative and individual analyte mode input spreadsheets from the "All Fields" formatted Pre-Extracted PDP data based on criteria applied to any of the available data fields using the Microsoft Excel® AutoFilter function. To install the RDFgen™ Input Generator Excel Add-in, launch Excel® from the Start menu. From the Excel™ menu, select Tools→Add-Ins. In the resulting Add-ins window, click the Browse button. Browse to *E*:\ Input Generator Excel Add-in (where *E* is the drive letter of your CD-ROM). Double-click on "RDFgen Input Generator.xla". Click Yes when prompted, "Copy 'RDFgen Input Generator.xla' to Microsoft Excel Add-in Library?" Click OK in the Add-ins window, and OK again when confirmation message verifying add-in installation appears. A "Create RDFgen Input Spreadsheet…" command will now be present in the Tools menu of Excel®.

If desired, you may use Windows Explorer to create a shortcut to **C:\Program Files\Novigen\RDFgen\RDFgen.exe** on your desktop. The RDFgen™ module can also be launched using the menu command in the DEEM™ main screen.

The "All Fields", "Individual Analyte Mode", and "Cumulative Mode" formats of the Pre-Extracted PDP data may be used directly from the CD-ROM, from a network share (see your network administrator if this interests you), or they may be copied to the directories of your choice on your hard drive using Windows Explorer. It is recommended that you have at least 1 gigabyte (GB) of free disk space on your hard drive if you select the latter option. If you do copy the Pre-extracted PDP data sets to your hard drive, you may wish to create a directory structure similar to this: "C:\PDP DATA\", which contains "C:\PDP DATA\94-7 All Fields\", "C:\PDP DATA\94-7 Ind Analyte Mode Inputs\", and "C:\PDP DATA\94-7 Cumulative Mode Inputs\". Note that RDFgen™ always "remembers" the directory from which you last opened an input spreadsheet, reducing the need to repeatedly browse to the pertinent directory.

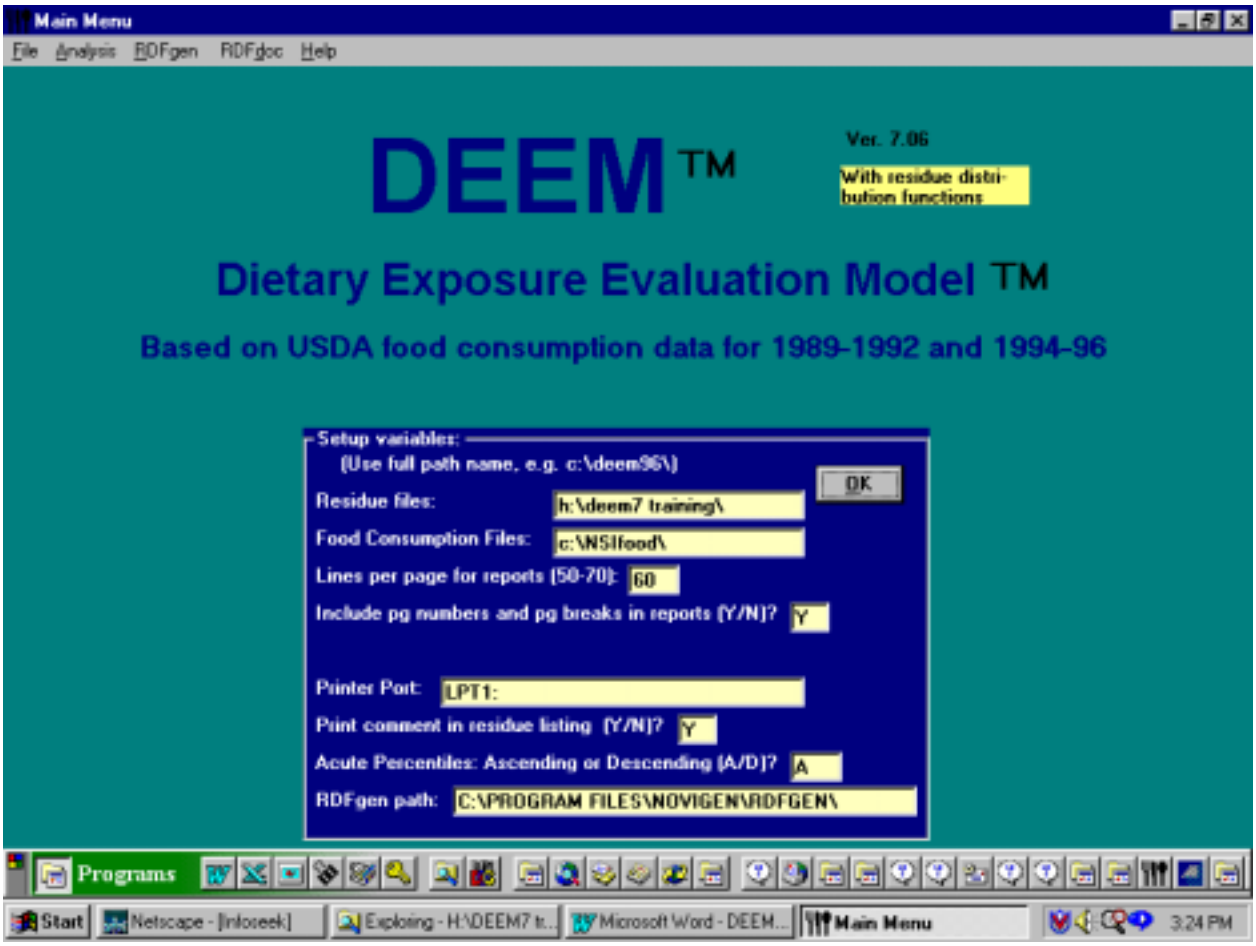
2.3 GETTING STARTED

DEEM.EXE is the main program module for the DEEM™ programs. There are several ways to launch DEEM.EXE. You may click on the DEEM icon in your Program menu, or run *C:\DEEM*\deem.exe (where C*:\DEEM* is the directory you specified during DEEM™ Setup) from your "Run" window. A shortcut to DEEM.EXE may also be created on the Windows® desktop. This allows DEEM™ to be launched by double-clicking its desktop icon. (You can even start DEEM™ from the DOS prompt in the \deem directory by typing "DEEM" and pressing the <enter> key. Of course, you must still have Windows® installed on your computer for this to work, since DEEM™ is Windows®-driven).

Once the initial screen has appeared, the DEEM™ program logo and licensing information will be displayed. The following functions are accessed from the menu bar across the top of the screen:

File
Analysis
RDFgen (note that this is an optional module)
RDFdoc
Help

Click on "File" then "Set Up" to establish the default directory locations for the residue analysis files that you will be building and saving, and the location of the food consumption files (usually located in a separate file directory) required to run the DEEM™ Acute Analysis program module. Screen 2.1 will appear.



Screen 2.1: Setup Variables Screen

Enter the name of the directory where you would like the residue files that you will be creating to be saved; next, enter the name of the directory where the food consumption files are located. Also, indicate the number of lines per page that will accommodate your printer. You have the option of including page breaks in reports that are generated by DEEM™ . The Setup Variables Screen also requires identification of a printer port. You have the option of including the source documentation in your residue file. The comment documentation is an optional feature when creating the residue file. It permits a limited amount of documentation for identifying residue data sources. This feature will be discussed in detail in Chapter 5*, Building Analysis Files*. The user has the option to display the acute exposure percentiles in ascending or descending order. Finally, the path for RDFgen™ may be specified. Once information has been entered click on the "OK" button. The Main menu then will be displayed.

Note that, if a menu bar item is grayed out, it is an indication that the menu bar item is not available at that time. In most instances where an "OK" or a dialog box is displayed with "Yes," "No," and/or "Cancel," you must respond appropriately to the requested input before you can continue with other functions.

Other options available from the File button include:

> Residue File Editor to create, edit, save, or print a residue analysis file. A residue analysis file is required when running either the Chronic or the Acute Analysis modules of the DEEM™ program. The procedures for creating the residue files for use in the chronic and acute risk assessments are discussed in Chapter 5, *Building Analysis Files*.
>
> *Exit* returns you to your operating system.

The menu bar also contains an *analysis* button and a *help* button. The analysis button gives the user the option of running a chronic or acute dietary exposure analysis.

Help explains each item on the menu bar and provides a discussion concerning basic background information on the program.

Two additional programs may be accessed from the menu bar, RDFgen™ and RDFdoc.

The RDFgen™ module of DEEM™ automates residue distribution adjustments and the creation of summary statistics and residue distribution files using the RDFgen™ Pre-extracted PDP data sets or user-supplied data. Using the Residue File Editor, the mean value of an adjusted residue distribution calculated by RDFgen™ can be entered for a chronic risk assessment, or an RDF file generated by RDFgen™ can be referenced for an acute risk assessment. RDFgen™ can also perform adjustments to the residue levels in order to generate cumulative RDF files. RDFgen™ will allow the user to do these analyses automatically using the PDP data for samples that have been tested for multiple analytes or manually using user-supplied data. RDFgen™ is an optional module.

RDFdoc provides a convenient way to display residue distribution files (RDFs) used in the Monte Carlo acute analyses.

Any menu bar item may be accessed by simultaneously pressing <Alt> and the underlined character.

CHAPTER 3. VALIDATION OF PROGRAM INSTALLATION/OPERATION

Novigen has provided you with four residue files (labeled TOLERANCE7.RS7, CHRONIC7.RS7, ACUTE7.RS7 and ACUTEMC7.RS7) and a number of residue distribution files (RDFs). Also provided are results from chronic and acute analyses (with and without Monte Carlo simulations) using these residue files. These examples will be used throughout this manual to demonstrate the program applications and subsequent interpretation of the analyses.

These files also will be used to confirm that the installation of the program has been successful and that the results obtained using your program are the same as those produced by the master program.

The residue files and corresponding results are located in the "DEEM QA Files" directory on the CD-ROM labeled "DEEM™".

CHAPTER 4. GUIDELINES FOR CONDUCTING EXPOSURE ASSESSMENTS

4.1 INTRODUCTION

The DEEM™ Software can be used to estimate dietary intake of toxicants, nutrients, pesticides, food additives, and natural constituents -- in short for any component of food or water. These agents can include inorganic and organic chemicals as well as microorganisms or toxins produced by microorganisms, whether naturally or synthetically created.

The mere presence of a substance in the food supply does not imply any adverse health consequence. In fact some substances of interest are essential nutrients; however, virtually all agents are toxic at some dose. Even essential nutrients may be toxic, albeit it at levels that are higher than the levels that are essential. Exposure levels should guide the understanding of the significance of the presence of any agent in the diet. Although the interpretation of the results may be different, the methodologies for estimating exposure are similar for toxins, nutrients and microorganisms.

Agents can be found in food and water either as a result of absorption from the household air, surface transfer, or from other activities in the home. Food and water also can come in contact with agents outside the home. In addition, agents can be ingested from transfer from the environment to the hands and then to the mouth. Thus, it is possible, and in fact likely, that there will be multiple sources of the agent.

Ingestion will contribute varying amounts to exposure since foods will contain different amounts of each agent on different days. And finally, the diets of individuals vary--both between individuals and in the same individual from day to day.

The goal of the exposure assessment should be to characterize the exposure of the population of concern and to identify the variability in that exposure. This chapter will guide the assessor through the components of a dietary exposure assessment.

4.2 OVERVIEW OF INGESTION METHODS

Typically, the primary objectives are to estimate the level of ingestion of the agent and to identify the sources of both variability and uncertainty in the estimate. In addition, the intake estimate may be useful in aggregate exposure assessments to identify the potential importance of diet relative to other pathways of exposure and to indicate where consumption of a particular food commodity or other dietary characteristic (i.e., age, regional and ethnic preferences) would indicate the potential for unique exposure patterns.

In order to assess the ingestion pathway to total exposure, three types of data are required:

(1) potential constituent levels in food and water, (2) frequency of occurrence of the agent in food, water or on the hands, and (3) amounts of foods that are consumed by the population being evaluated.

The selection of the most appropriate methodology will depend upon (1) the intended application for the exposure assessment, (2) the biological properties of the constituent, (3) the physical and chemical properties of the agent, (4) the route of entry into food and water, and (5) relative contribution of ingestion to overall exposure. Some of the important considerations for each of the five areas are discussed below:

1. Intended application of the exposure assessment

   The purpose of the assessment will play a critical role in determining the most desirable methodology. Different methods will be desirable if the assessment is designed to be conservative (as is often the case for regulatory decision-making applications) rather than if it is designed to be as realistic as possible. Some approaches, such as those that assume the food supply contains tolerance-level residues are designed as "screening" methods. The assumption that foods contain residues at the maximum legal limit produces a worst-case intake estimate (often called the theoretical maximum daily intake (TMDI)), that dramatically overestimates exposure. Although it can be very useful for preliminary assessments, it is not reliable as an estimate of <u>actual</u> intake for use in establishing priorities or for designing sampling programs. Screening methods and model diet methods for assessing exposure sacrifice accuracy for speed, simplicity, and are known to be over-estimations of exposure. In the case of the evaluation of toxic effects, results that predict that intakes will be less than an acceptable daily intake level (ADI) are assumed to mean that exposures will be acceptable. Thus, it can be assumed that there is no need to expend resources to collect better data or to apply more sophisticated techniques in search of greater accuracy. More realistic estimates usually will be needed before final regulatory decisions are made. Research projects designed to evaluate the cause-effect relationship of an agent and a disease require more accurate exposure assessments.

2. Biological properties of the agent

   The length of dosing that is required to elicit a specified biological effect should define the key exposure assessment parameters. That is, the biological effects that are the result of a single or, at most, few doses should be compared to dietary exposure on a single day. Correspondingly, toxic effects that arise as a result of long term exposure will be compared to average dietary exposures (usually over a year).

Other considerations include: (1) whether any breakdown products of toxicological significance are produced and (2) metabolic pathways in plant and animal systems. Potential biological effects must be carefully considered in planning an exposure assessment. Factors of interest include dose-response relationships, the length of exposure required to produce an adverse effect, potentially sensitive populations, and variability and uncertainty factors.

3. Physical and chemical properties of the agent

Often when estimating intake of a substance in food, it is necessary to define or characterize the substance in terms of attributes such as structure, volatility, and solubility since complete data typically aren't available. Questions of concern that are related to the agent's properties once in the food or water include: Does the substance break down during storage? During processing? During cooking?

Physical properties of the agent that may be evaluated include 1) particle size, 2) presence in household air, 3) surface to hand transfer , and 4) rates of deposition in food or water.

Because our diets are highly processed, it will be critical for most assessments to include estimates of the residues in the products as they are consumed (Chin, 1991 and Elkins, 1991). The DEEM™ software is designed to allow this information to be added as an adjustment factor.

4. Route of entry of the agent into food and water

The origin of an agent in food is important to consider when selecting the foods to be included in the analysis and to identify the most appropriate information about likely concentrations. For example, is the agent naturally occurring? Is the agent entering the food prior to the food entering the home? Or does it enter the food as a result of activities within the home?

Concentrations of a substance may vary due to differences in the cultivation, season, or region of growth, but the substances generally would be expected to occur at some level in all raw plants or uncooked meat of the same type (an exception would be nutrients or other natural toxins bred into plants by genetic engineering). The extent to which the compound will be present in processed forms of the relevant foods depends on volatility and breakdown characteristics of the chemical and its metabolites.

Often it is possible to determine the foods that may contain the agent by evaluating source and transport information for the agent. If it is possible to group foods into categories it may be possible to extrapolate data for one food to other foods for which data are not available. For example, if the constituent level in oranges is expected to be similar to that in grapefruit, it would then be possible to conduct the exposure analysis for "citrus." These food categories can then be used to select the most appropriate food consumption data for the assessment.

5. Contribution of diet to aggregate exposure

Typically when dietary intake is to be integrated into exposure from other routes, screening methods will be too crude and will need to be replaced with more accurate estimates of intake. In those instances even preliminary (range-finding) assessments may require more refined estimates of the concentrations in those foods that appear to be contributing most to the theoretical exposure estimates. It may also be desirable to include information about the effects of processing or cooking.

4.3 EXPOSURE ASSESSMENT MODELS

There are four general exposure assessment models: point estimate, simple distribution, Monte Carlo-type probabilistic, and multiple chemical exposure.

A. Point Estimate

A point estimate of exposure to a specific chemical by a particular population is a broad estimate generated using one number to represent concentration of the chemical in each food and one number to represent intake of these foods by that population. In estimating chronic exposure, the arithmetic mean of residue concentrations is most commonly used; however, if the distribution of pesticide concentrations is known to be skewed, use of the median (or 50th percentile) concentration is more appropriate (Mosteller and Tukey, 1977). Exposure to acutely toxic chemicals frequently is assessed using the 95th percentile residue concentration in order to produce a "worst-case" estimate.

Typically, the most basic models combine data on average intake and average concentration levels of the agent to estimate average exposure. Average **chronic** exposure usually is estimated on a per-capita consumption basis and is compared to the measure of biological/toxicological results from life-time animal feeding studies or other appropriate test results.

B. Simple Distribution

Single day or "acute" exposures may be computed using similar methods but using food intake data for a single meal or for a single day. Acute exposures are usually compared to results of tests in which subjects were dosed for a single day. A simple distribution of exposure can be calculated by either of two procedures: (1) a single number chosen to represent concentration of the substance in each of the foods of interest may be applied to a distribution of intake levels for each food, or (2) a single number chosen to represent food intakes can be applied to a distribution of toxin concentration values.

Current US EPA policy is to utilize a tiered approach in assessing acute dietary exposure. The Tier 1 analysis utilizes the entire consumption distribution and a single upper-bound residue value (usually the tolerance or highest average field trial (HAFT) residue) for all foods included in the analysis. In the Tier 2 analysis, a single upper-bound residue value is used for those commodities considered to be single-serving foods (e.g., a raw apple or an orange); mean field trial residues (or 95th percentile residues from pesticide monitoring data) are used for processed or blended commodities (e.g., grains, oils). (Tiers 3 and 4 are discussed below.)

To illustrate models that use a distribution, the tomato consumption distribution from the 1989 through 1991 CSFII is presented in Table 4.1. This analysis includes all tomato products that were reported as consumed. Combining this with a single residue value would produce a simple distribution of exposure.

Table 4.1 Distribution of reported tomato consumption by the US population in the 1989-91 USDA Continuing Survey of Food Intake for Individuals (including whole tomatoes, catsup, puree and sauces)

	GRAMS CONSUMPTION/KG BW/DAY
Mean/user	1.4
Percentiles:	
90	3.3
95	4.5
99	7.6
99.9	13.4

C. Monte Carlo-type probabilistic assessment utilizing both the anticipated distributions of residue levels and the distribution of food intakes

Joint distribution analysis (usually referred to as Monte Carlo Analysis) relies on sophisticated calculations to allow combination of representative data using a distribution

of toxin concentrations and a distribution of food intakes. In joint distribution analyses, best-case and worst-case scenarios of intake are shown on the same table or graph to be reviewed simultaneously.
Monte Carlo analyses characterize a population's exposure based on data on a random sample from that population. In calculating the joint distribution, the Monte Carlo approach assumes that both the residue and consumption distributions belong to a parametric family (e.g., normal or lognormal).

Calculations are performed as follows:

1. Random samples (size depending on the number of iterations) are generated from the residue distributions.

2. Each value from the sample of consumption values is multiplied by each value from the sample of residue values.

Steps (1) and (2) are repeated thousands of times, and the resulting distributions are merged together to produce an estimate of the exposure distribution.

In creating a joint distribution to estimate exposure, the distribution of food consumption is combined with the distribution of agent concentration levels. Joint distribution probabilistic analyses allow the most realistic estimates of exposure.

EPA's Tier 3 acute analysis approach incorporates the entire consumption distribution AND the entire field trial residue distribution for single serving foods; mean field trial (or 95^{th} percentile monitoring) residues are used for processed/blended commodities. The Tier 3 analysis also may incorporate percentages of the crop that may be treated with the chemical of interest. EPA's Tier 4 analysis utilizes the entire consumption distribution and residue distributions from statistically designed market basket surveys.

D. Exposure to Multiple Chemicals

Estimates of combined exposure involve considerations not required for exposure to one chemical. Residues of chemicals cannot be simply summed for use in exposure assessment; the chemicals may have different toxic effects and/or different potencies. One approach is to standardize the residue data by applying a toxicity equivalency factor or TEF to convert to a common activity level. The chemicals may also have different processing factors, requiring a Processing Coefficient to be applied separately to residue values for each chemical to achieve normalization. The RDFgen™ Cumulative Mode includes automation of the application of these factors/coefficients, as well as the ability to perform multiple chemical Percent Crop Treated Adjustment accounting for probability of concurrent treatments, and multiple chemical decompositing. Output from RDFgen™ Cumulative Mode includes a cumulative Residue Distribution File for the commodity of interest, suitable for immediate use in the DEEM™ Acute Module.

4.4 MEASUREMENT OF POTENTIAL EXPOSURE PATTERNS OF SUBGROUPS (INFANTS, CHILDREN, REGIONS, ETC.)

For most purposes, it will be desirable to assess both the overall population's intake and the intake for selected population subgroups. For example, infants diets, on average, contain a higher proportion of ingredients that are often used in commercially-prepared infant formulas. These ingredients include soy protein isolate and oil, coconut oil, lactose (milk sugar) and water. Infants also have a much higher intake of water/per unit body weight than do others in the population. In contrast, they eat no broccoli. Their raw apple consumption is minimal; however, they do eat substantial amounts of processed apples and apple juice. For young infants, an important source of exposure to fat-soluble and other environmental agents is human breast milk, which is not included in the USDA CSFII consumption database.

Children from 1 to 6 years of age also have a higher intake of many fruits and vegetables (on a gram per kg/bw basis) than do older members of the population. They also eat significant quantities of peanut butter. Both infants and young children consume large quantities of milk. (Note that in the DEEM™ program, milk is broken into 4 categories: nonfat solids, fat solids, milk sugar (lactose) and milk-based water. This was done to avoid double counting when a component of milk is consumed alone. Examples include milk-fat solids in butter, milk sugar in infant formula, non-fat solids in yogurt, etc.) All populations have increased their consumption of corn sugar in the past 10 years—most likely due to changes in the sugar content of many commercially prepared foods.

Other subgroups of the population also report differences in the foods they eat. For example, based on data from the 1989 through 1991 CSFII, the Hispanic subgroups consume more corn and less wheat than other ethnic groups. Fortunately, the US national surveys identify key demographic information so that subgroup analysis is feasible.

The method of assessing exposure may depend on whether the population in question is considered to be particularly vulnerable to the agent. Concern over children's exposure to toxins, especially to pesticides, prompted the US Congress to request the National Academy of Sciences, National Research Council (NAS-NRC), to conduct a thorough review of scientific and policy issues concerning pesticides in the diets of infants and children. The NAS-NRC committee recommended that methods be developed for evaluating distribution of exposure in vulnerable populations, for assessing exposure from all foods combined rather than from individual commodities, and for assessing combined exposure from pesticides with similar toxic effects (NRC, 1993). A number of sophisticated new methods for assessing exposure have been developed in response to these recommendations.

4.5 TECHNIQUES TO ASSIST IN DEFINING THE EXPOSURE SCENARIO

In addition to magnitude and frequency, sources of exposure must be defined. It is desirable to know how the agent entered the food supply and the time frames that are involved. It is important also to know whether the dietary exposure is correlated with other routes of residential exposure or whether it arises due to a separate source.

The following will help to define the most appropriate exposure scenario:

- Identify the regulatory standards that apply to the agent. For example, permitted uses of a pesticide on food crops.

- Determine the characteristics of intended or accidental additions of the agent to the food supply. Determine the impact of processing/cooking and storage of foodstuffs on the final levels of the agent.

- Identify and evaluate existing data for both the levels of the agent and for the appropriate food consumption estimates.

- Create draft exposure assessment algorithms that define the parameters to be computed and the models to be used to estimate exposure. If appropriate, develop a tiered methodology that allows a sequence of analyses from "range finding" to detailed probabilistic exposure assessments.

- Conduct appropriate preliminary exposure assessments including "sensitivity analyses" to assist in defining the parameters that need the best available data and/or additional data generation.

A. Sources of the Substance

The substance of interest may be present in or on food accidentally due to environmental factors such as air pollution, water pollution, accidental contamination, or microbial contamination. The presence of agents from such sources would be expected to vary significantly depending on geographic location or other factors. Biological agents, once entering the food supply may increase or decrease depending upon growth characteristics.

Agents present in food may be there incidentally, added indirectly to foods as a result of migration from packaging or a processing step. In general, agents incorporated incidentally are more likely to be present in processed foods than in raw agricultural commodities.

Agents may be present in or on food because they were added deliberately during some phase of production or processing of food.

B. Quantifying the Concentration of the Substances

The analyst's goal is to characterize the concentration of the agent in each food. Priority should be placed on foods that contribute most to exposure. To assess exposure to a substance, it is important to consider not only the average concentrations in foods, but also the variability of the constituent level.

Existing data may be used to estimate exposure and to guide the collection of future data. A substantial amount of information that is relevant to exposure assessment, and hence risk assessment (Graham *et. al*., 1992 and Sexton *et. al.,* 1992), is available for some compounds. Such information can be obtained from existing databases on food and drinking water consumption and contaminant residues normally maintained for other purposes (nutritional intake or regulatory surveillance). The US FDA Total Diet Study (Pennington and Gunderson, 1987), USDA Nationwide Food Consumption Survey (NFCS), NCHS National Health and Nutrition Examination Surveys (NHANES), as well as federal and state regulatory monitoring programs, for example, provide information useful for dietary exposure modeling and assessments.

1. Useful information for defining those foods having the highest potential concentration of the agent includes:

    a. Chemical characteristics

        i. Solubility
        ii. Heat stability
        iii. pH stability
        iv. Other chemical properties

    b. Metabolites/degradates of potential concern - evaluation of structure of parent
    c. Levels in raw versus cooked food

    d. Levels in home-prepared versus commercially-processed foods

    e. Time frames for presence of agent in the food supply or in categories of the food supply—continuously, periodic intervals

    f. Impact of processing/home preparation on potential residues

2. Market basket and surveillance sampling

    The US and other countries conduct various types of monitoring or surveillance for agents in commodities or in foods. Monitoring and

surveillance studies are conducted to assess compliance with state, national or international regulations.
At the US federal level, USDA monitors residue levels in domestic and imported meat and poultry products, and FDA monitors residue levels in all other foods. California, Florida, and a number of other states have monitoring programs; a national database, FOODCONTAM, incorporates data from monitoring programs in ten states (Minyard and Roberts, 1991). These programs monitor for pesticides, veterinary products, heavy metals and nutrients. Not all programs monitor for all classes of compounds. There is little surveillance for microbiological agents except when there is reported illness. The various monitoring programs are described in greater detail in the following sections.

Depending on the specific US monitoring program, foods or commodities may be sampled at the point of entry to the country, at the farm gate, at the food processing plant, or at the retail level. Since it is logistically and economically impossible to analyze each and every shipment of every food and commodity, studies are often conducted on target samples suspected to be out of compliance. While the resulting data are not statistically representative, they may be useful for "range finding" studies.

Market basket surveys are conducted in the US and other countries to obtain food chemical concentration data that may be used in exposure assessment. A core group of foods representative of national dietary patterns is obtained and analyzed to determine the concentrations of the substances of interest. Generally, samples of food are purchased at retail outlets in different regions of the country and prepared as for consumption.

The US FDA Total Diet Study

Since 1961, the US FDA has conducted a yearly market basket survey, the Total Diet Study (TDS). Although not statistically based, the TDS does yield data useful in exposure assessment. Samples of 265 foods chosen to represent the US food supply are collected four times each year, from three cities in each of four US regions. Samples of individual foods from these three cities are composited for analysis. Because the TDS uses only a few hundred foods to represent thousands of foods, results must be interpreted cautiously. The multi-residue methods of analysis are capable of detecting over 200 pesticides and industrial chemicals, radionuclides, and essential and toxic elements, including arsenic, lead, cadmium and mercury. Estimates are made of the intakes of various age/sex groups based on consumption data from USDA's Nationwide Food Consumption Survey (NFCS, USDA, 1981) and NCHS' National Health and Nutrition Examination Surveys (NHANES, NCHS 1982). The TDS diets are

aggregated so that the food items collected are representative of all food consumed in the US. For example, apple pie represents not only all the various types of apple pies (homemade, bakery, fast-food, frozen, deep dish, apple with raisin, apple with cheese, and so forth) but all fruit pies, strudels, crisps, turnovers, and pastry with fruit (Pennington, 1983). TDS could provide the framework for a national dietary exposure monitoring program with enhancements to the sampling design and the addition of more foods and contaminant analysis (FASEB, 1993). Concentration data on the foods sampled can be used as reference points in designing rough exposure assessments—especially for guiding subsequent studies.

Consumption Data: NFCS and NHANES

Although both surveys contain a dietary intake component, they are quite dissimilar in purpose and in elements other than dietary intake. The purpose of the NFCS is to "measure the food and nutrient content of the diet and the money value of food used by US households and the food and nutrient intakes at home and away from home of individuals" (NRC, 1989). The purpose of the NHANES is to "develop information on the total prevalence of a disease condition or a physical state; to provide descriptive or normative information; and to provide information on the Inter-relationships of health and nutrition variables within the population groups" (NRC, 1989).

For a variety of reasons the USDA National surveys provide data that are quite appropriate and useful for assessment of exposure to food toxins:

- Foods coded are numerous and very specific. More than 6000 different foods have been reported as consumed in at least one year of the surveys between 1987 and 1994.

- Foods are coded in a hierarchical structure, allowing easy aggregation and disaggregation of data in estimating exposure.

- Data on multiple days of intake allow estimation of acute or chronic exposure. (Calculation of usual exposure from data collected on consecutive days is complicated by the non-independence of intakes over these days. This limitation has been corrected in the 1994 and later years of the CSFII. For these survey years, data were collected on two non-consecutive days.)

- Distributions of intake may be calculated.

- Data on age, sex, race, region, season, pregnancy and nursing status allow exposure estimation for a wide variety of subpopulations.

- Body-weight data allow exposure estimations per unit body weight.

C. Validity, Reliability, and Sources of Error

The national consumption surveys and food monitoring programs are powerful tools for assessing dietary exposure and evaluating status and trends. One must realize these data are not intended to represent the true diets of all people at all places and that applying these data too broadly may result in false conclusions or poor estimates in dietary exposure for specific populations. The factors affecting the exposure of an individual or small subset of the population to a specific pollutant are not evaluated by using a national average diet and nationwide residue monitoring data (Lioy, 1990). Market-basket surveys reveal little about unique, individual dietary practices that vary from the US norm, such as those of small children living in lead-laden homes. Care must be taken in the application of these data for specific situations, such as when evaluating residential exposures.

The process of preparation, storage and consumption of foods in the residence or other eating places can affect an individual's exposure. Such factors are normally not included in risk assessment because they are not well understood or documented. Contamination of food occurs beyond the production and retail distribution system. Additional exposure may come from non-retail food sources such as home-grown food or fish/game. Pesticide use in the residence can be an important source of food contamination; bug bombs or foggers can contaminate both foods and the surfaces they contact (Sheldon *et. al.*, 1994). Soiled cooking utensils and dinnerware, food hygiene practices, and food contact with dusty surfaces contribute to excess dietary exposures. A better understanding of the interactions of foods with other contaminated media, such as the addition of contaminated water and contacts with contaminants in air and on surfaces during preparation, is needed so that the importance of other contaminated residential media on dietary exposure can be better assessed. It is important to have an overall understanding of the exposure scenarios that lend most to contamination of foods and beverages and hence, excess dietary exposures. In general, market basket surveys do not measure levels of contamination in foods "as consumed." In many scenarios, personal dietary measurements are needed when market-level monitoring cannot discern exposures for specific microenvironments, such as a residence, or when comparisons to directly measured exposures from other pathways are required.

4.6 GUIDELINES FOR REPORTING THE RESULTS

A. Clearly identify and reference the data and software used in the analysis.

B. Fully describe the methods and assumptions that were used for samples with residues below the LOD.

C. Explain the uncertainty of the results. Regardless of the exposure analysis model used, the uncertainty associated with exposure estimates should be evaluated and presented. Uncertainty can be characterized qualitatively, i.e., the thought processes used to select or reject specific data, or quantitatively, i.e., ranges of exposure (EPA, 1992). Uncertainty may result from missing or incomplete data; measurement or sampling error, or use of surrogate data, gaps in scientific theory used to make predictions, and how well the theory or model represent the situation being assessed. Analysis of uncertainty provides decision makers with information concerning potential variability in exposure estimates and the effect of data gaps on exposure estimates.

D. Clearly note related assumptions.

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CHAPTER 5. BUILDING ANALYSIS FILES

Program Options

Table 5.1 summarizes the actions available from the DEEM™ Residue File Editor menu bar.

TABLE 5.1 RESIDUE ANALYSIS FILE ACTIONS

- File (create, open, save, print, close files and exit to main menu)
- Add/Edit Header Information
- Add/Edit Foods/Foodforms
- Crop Group Actions
- Help

Crop Groups

The EPA may register pesticide uses for single crop items (apples, corn, oranges) or for whole categories of botanically similar items (e.g., pome fruits, grains, citrus). These categories are called Crop Groups. Table 5.2 lists the crop groups defined by EPA and used in DEEM™ together with their program codes. As previously mentioned, Appendix A identifies the foods and associated food forms that are assigned to each crop group.

TABLE 5.2 EPA CROP GROUPS

CROP GROUP	DESCRIPTION
1	Root and Tuber Vegetables
2	Leaves of Root and Tuber Vegetables
3	Bulb Vegetables
4	Leafy Vegetables (except Brassica)
5	Brassica (Cole) Leafy Vegetables
6	Legume Vegetables (Succulent or Dried)
8	Fruiting Vegetables
9	Cucurbit Vegetables
10	Citrus Fruits
11	Pome Fruits
12	Stone Fruits
13	Berries
14	Tree nuts
15	Cereal Grains
19	Herbs and Spices

Note: The DEEM™ software also includes the EPA subgroupings for these crop groups, as well. Crop groups 7, 16, 17, and 18 are livestock feed items and, thus, are not included in the consumption database.

The DEEM™ program permits the user to enter data for an entire crop group or for individual foods within a crop group. In addition, it is possible to enter residue data for subsets of the foods, called "foodforms."

FoodForms

Foodforms (FF) are used to further categorize a specific food into various forms of the food. For example, for the 1994/96 consumption database, the commodity apples is broken down into the FF uncooked, cooked (NFS[1]), baked, boiled, fried, dried, canned (NFS), canned: cooked, canned:baked, canned:boiled, and frozen: cooked. Use of FF allows the user to enter specific data, if available, for a particular form of the food. For example, residue levels may be substantially reduced in a heated form of a particular food.

Table 5.3 lists the FF used in the DEEM™ 1989/92 and 1994/96 databases. (Note that because different consumption data are reported in the surveys, not all FF are used in both databases.)

TABLE 5.3 FOODFORMS

11 "Uncooked"
12 "Cooked: NFS"
13 "Baked"
14 "Boiled"
15 "Fried"
16 "Pasteurized"
18 "Dried"
20 "Microwaved"
21 "Barbecued"
31 "Canned: NFS"
32 "Canned: Cooked"
33 "Canned: Baked"
34 "Canned: Boiled"
35 "Canned: Fried"
36 "Canned: Microwaved"
37 "Canned: Barbecued"
39 "Canned: Dried"
41 "Frozen: NFS"
42 "Frozen: Cooked"
43 "Frozen: Baked"
44 "Frozen: Boiled"
45 "Frozen: Fried"
46 "Frozen: Microwaved"
47 "Frozen: Barbecued"
48 "Frozen: Dried"
51 "Cured: NFS (incl. smoked/pickled/salted)"
52 "Cured: Cooked (incl. smoked/pickled/salted)"
59 "Cured: Cried (incl. smoked/pickled/salted)"
60 "Canned: Cured"
98 "Refined"
99 "Alcohol/Fermented/Distilled"

[1] NFS = Not further specified.

An Example – NOVICHEM

We will use DEEM™ to analyze a hypothetical chemical called "NOVICHEM" in order to provide examples of the program applications and subsequent interpretation of analysis reports. A number of important features of DEEM™ will be illustrated with this example, including:

(1) translating the residue into equivalent DEEM™ foods and foodforms (Chapter 5)
(2) building new residue files and modifying existing files at three program levels, i.e., at the food, foodform, and crop group levels (Chapter 5)
(3) changing adjustment factors (Chapter 5)
(4) changing residue levels (Chapter 5)
(5) conducting exposure assessments for the US population and for population subgroups (Chapters 6 and 7)
(6) Commodity Contribution Analyses (Chapter 5)
    (a) complete commodity listings
    (b) critical commodity listings
(7) Critical Exposure Commodity Analysis (Chapter 7)

After each DEEM™ procedure is described, we will apply the procedure to NOVICHEM.

NOVICHEM Tolerances

NOVICHEM is a pesticide registered for use on apples, cotton, peaches, nectarines, grapes, tomatoes, celery, lettuce, and strawberries. The manufacturer of the chemical has conducted a battery of chemistry, field residue, and processing studies. As a result of the studies, each of these crops has established tolerances. Secondary residues of NOVICHEM and its metabolites are found in meats (cattle, goats, swine, sheep, horse) and milk as a result of residues in cottonseed, cottonseed meal, and cotton gin trash. Table 5.4 lists the established tolerances for NOVICHEM.

TABLE 5.4 NOVICHEM TOLERANCE VALUES

Apples	0.035 ppm
Celery	0.100 ppm
Cotton	0.050 ppm
Grapes	0.050 ppm
Lettuce	0.100 ppm
Nectarines	1.000 ppm
Peaches	1.000 ppm
Strawberries	0.020 ppm
Tomatoes	0.020 ppm
Meat	0.100 ppm
Meat byproducts	0.200 ppm
Liver	0.200 ppm
Milk	0.050 ppm

NOVICHEM Anticipated Residues

For purposes of dietary exposure and risk assessment, the manufacturer has also determined anticipated residues for several items (Table 5.5). In addition to field trial and processing studies, the manufacturer also has information on the percent of the crop that is treated (Table 5.6).

TABLE 5.5 ANTICIPATED RESIDUES FOR NOVICHEM

Crop	Mean Field Trial Residue	Highest Average Field Trial Residue	Processing Factor
Apples	0.004 ppm	0.020 ppm	0.02 (juice) 0.20 (washed fruit) 0.05 (cooked fruit)
Celery	0.012 ppm	0.070 ppm	
Cotton	0.005 ppm	N/A	0.01 (oil) 0.02 (meal)
Grapes	0.003 ppm	0.025 ppm	1.0 (raisins) 0.06 (juice)
Lettuce	No data		
Nectarines	0.040 ppm	0.600 ppm	
Peaches	0.040 ppm	0.060 ppm	
Strawberries	0.007 ppm	0.014 ppm	
Tomatoes	0.004 ppm	0.011 ppm	0.02 (puree, juice, catsup) 0.50 (paste)
Meat	No data		
Milk[1]	0.005 ppm		

N/A = Not Applicable because cottonseed meal and oil are blended commodities.

[1] In the DEEM™ program, the commodity milk is broken down into nonfat solids, fat solids, lactose and milk-based water. All four fractions must be included when evaluating residues in whole milk.

TABLE 5.6 PERCENT OF CROP TREATED WITH NOVICHEM

Crop	Percent Treated
Apple	10%
Celery	25%
Lettuce	10%
Peaches/Nectarines	10%

NOVICHEM Toxicology

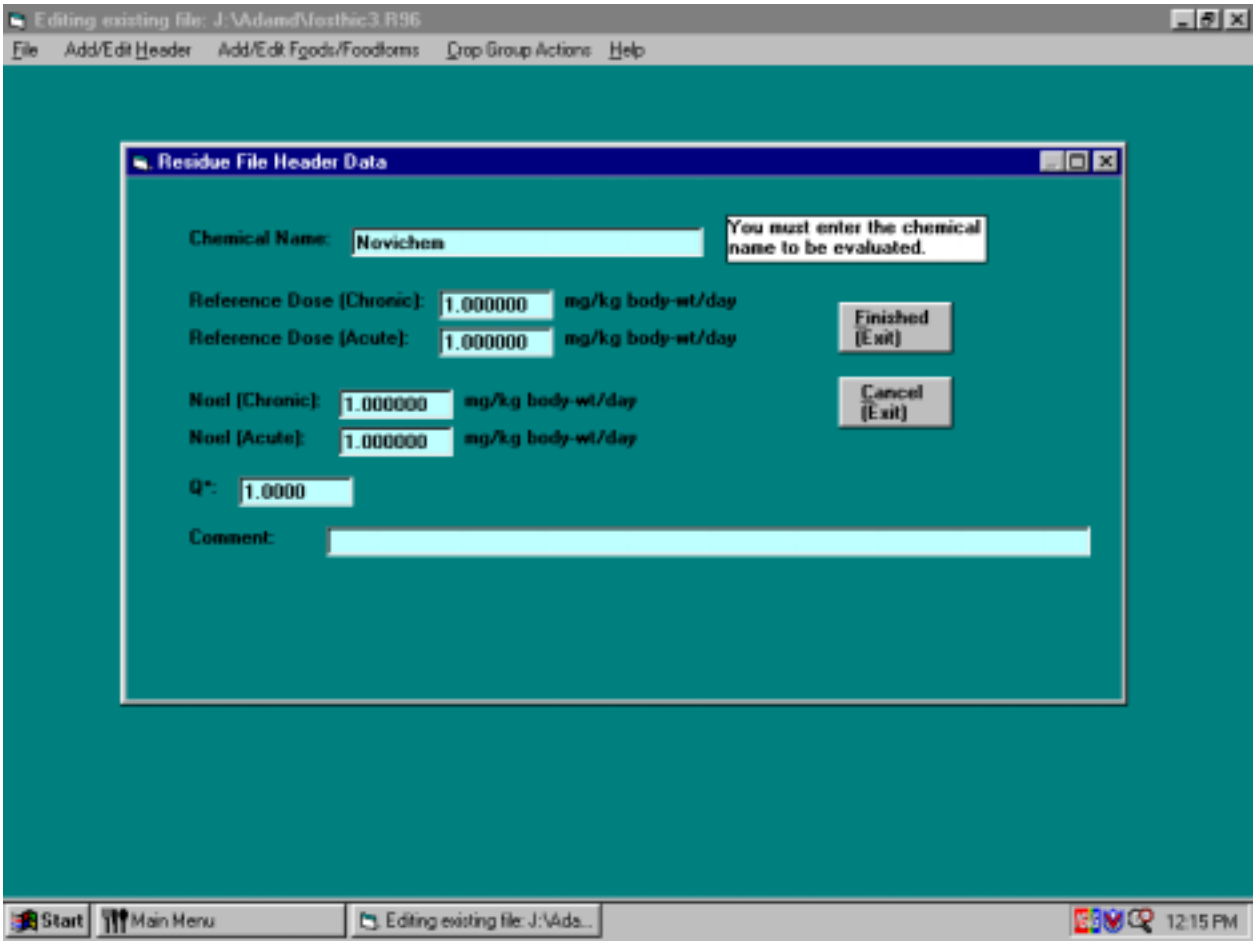
An ADI, based on the results of a chronic animal feeding study, has been set at 0.001 mg NOVICHEM/kg bw/day (NOEL is 1.0 mg/kg bw/day) and will be used for the chronic RfD. The cPAD is 0.0003 mg/kg bw/day for infants.

NOVICHEM also is an acute toxicant and the NOEL from a developmental study is 0.25 mg/kg bw/day. The acute reference dose (aRfD) is 0.0025 mg/kg bw/day and the aPAD is 0.0008 mg/kg bw/day for infants.

NOVICHEM Residue File

To begin building the residue file using tolerance-level residues for NOVICHEM, click on "File" then "Residue File Editor" from the main menu. Next, click on "File" then "New" to create a new file. You then will be prompted to enter the name of the file. At the prompt, type "TOLERANCE7" and press the enter key. (Note that the residue files will have the extension RS7. (This file may be used when conducting an analysis using either the 1989 through 1992 CSFII consumption data or the 1994 through 1996 CSFII data.)

Next click on "Add/Edit Header" then "Open Header." Screen 5.1 will appear.

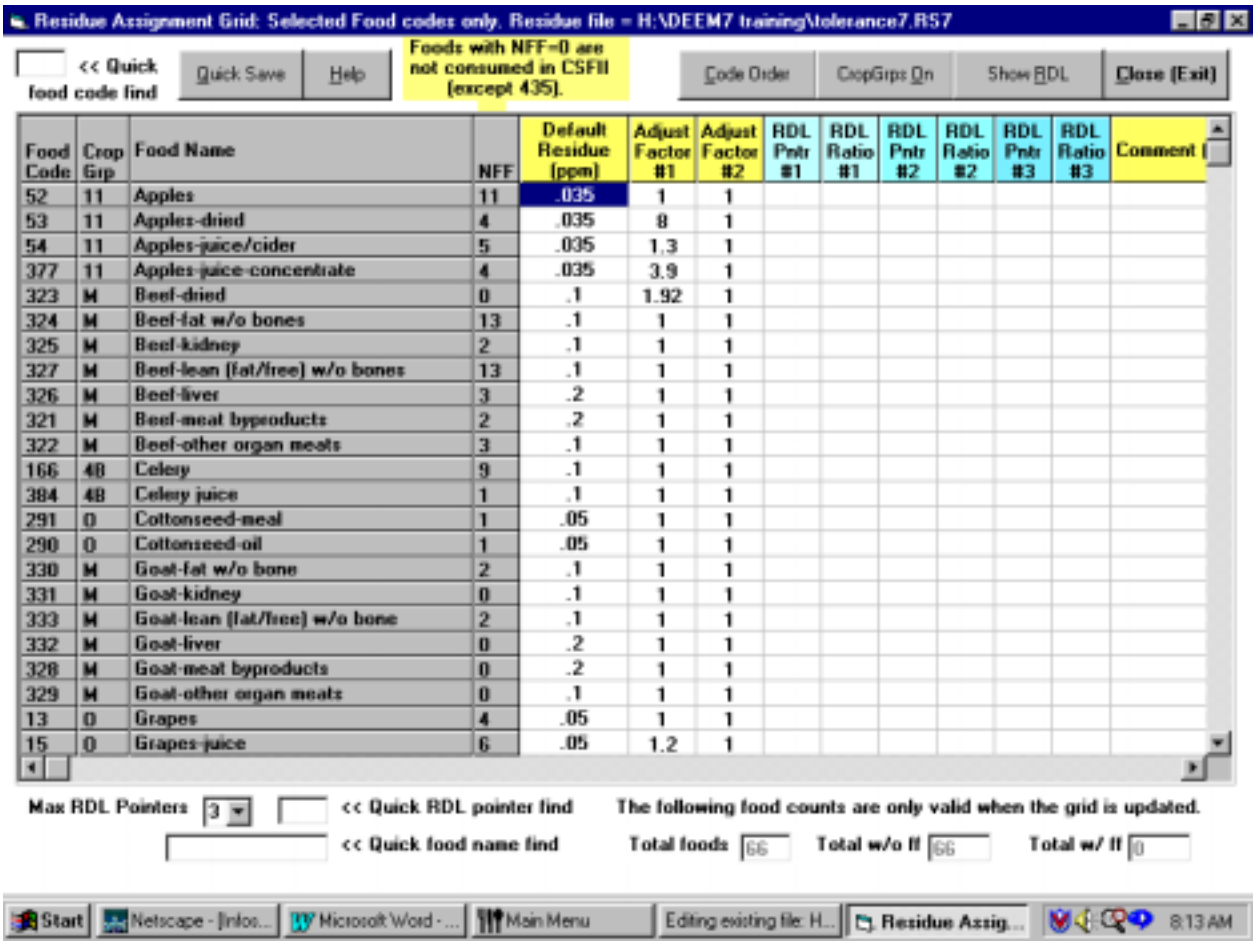


Screen 5.1 Header Information

Clicking on a field highlights the entire field. Entering data in the highlighted field will completely replace any information currently contained in the field. If you want to change a portion of the field, double click on the field and move the cursor to the appropriate location and perform the desired field edits. You may move from field to field with either the <Tab> key or the mouse. Hitting the <Enter> key will not advance the cursor to the next field. Note that you may enter a comment using the header option. This comment will appear in all the analyses that use this residue file. (Later you will have an opportunity to enter a second comment for that analysis only.) Enter the appropriate header information for NOVICHEM. Once you have completed entering the data, click on "Finished" to close the screen.

Add/Edit Foods

Next, click on the "Add/Edit Foods/foodforms" option from the menu bar. For existing files, you will be given a choice of viewing all the foods or only those included in your file. When creating a new residue file, you must select "All" foods. You may sort foods by foodcode or in alphabetical order. Screen 5.2 provides an example of a residue file sorted in alphabetical order.



Screen 5.2 Add/Edit Foods/foodforms

Note that information in the first four columns can not be modified by the user. The active columns in the food/foodform data entry grid are: residue value, first adjustment factor, second adjustment factor, RDL pointer #, RDL ratio #, and source comment. The RDL pointer # and ratio fields are used for Monte Carlo analyses only; the remaining fields are used for both chronic and acute analyses. (Entering data in the RDL pointer # and ratio fields is described in Chapter 7.)

Entering Data

The data entry procedure is similar to that used for spreadsheets such as Excel® or Lotus 123®. However, <Enter> will not move the cursor to a new cell. The cursor action depends on whether or not a value has already been entered in the residue field. To open the field for data entry or editing, move the cursor to the field and press <Enter>.

Double-clicking will also open the field.

Once the field is open, enter the residue value in ppm. DEEM™ permits entry of values less than 1000 ppm and greater than 0.000001 ppm. Note that data entry is restricted to 6 decimals.

If <Enter> is pressed after the residue value is entered into the field, the field is highlighted and subsequent values will overwrite the original data. To advance the cursor to another field, use the <arrow> keys. You may also advance the cursor to another cell by clicking on the cell.

You can enter the same residue value in a number of contiguous residue cells by clicking on the first cell with the left mouse button, and then, while holding the left mouse button down, dragging the highlighted area down to the last cell that you want to replace. You will get a confirmation note asking if you want to replace all of the values in the highlighted cells. If you answer affirmatively, the value in the first cell of the highlighted area will be entered automatically into the remaining cells. Note that you cannot highlight cells in more than one column at a time. You can highlight a contiguous area that includes only foods or only FF, but you cannot highlight a contiguous area that includes both foods and FF.

To copy a residue value into another cell, double click on the field to be copied, then move the cursor to the desired entry field and double click again. The value will be displayed in the new field.

The two buttons, "Quick Code Find" and "Quick Food Find," on the Add/Edit Foods/foodforms screen may be used to move to a specific RAC code or food. Simply enter the RAC code or food name, as appropriate, and press enter. The cursor automatically will move to that code/food.

Using Foodforms

Foodforms (at least 1 and as many as 31) are available for all foods that were reported consumed at least once in the CSFII. In screen 5.2, the number of FF for each food is shown in the column labeled "NFF." Foods with available foodforms will have a number greater than zero in the "NFF" column. A residue value can be entered for any food, whether or not it has FF. With the exception of nonfood-based water, foods with no FF (i.e., NFF = 0) indicate that there was no consumption reported in the survey; therefore, these foods will not have any impact on the analysis.

The food, nonfood-based water, is the amount of tap water consumed as a discrete food (i.e., not as a part of food or in food preparation). (Definitions of the foods and FF in the DEEM™ software are discussed in Appendix B.) The foods without FF are included in the list of foods to make it clear that such foods are not included under some other food name.

To include FF in your residue file, enter a residue value (in ppm) greater than zero. Then right click anywhere on the row where the food is listed. A confirmation message will be displayed; you must respond positively if you want the FF for this food to be shown. Initially the residue value for each of the FF is the same as the residue value entered for the food. You can change the values manually by clicking on the residue value and then adding a replacement value. Note: when you add FF to a file containing many foods with residue values, it may take several seconds for the display grid to be redrawn to the screen.

To delete FF, place the cursor on the food level; then right click on the row where the food is listed. A confirmation message will be shown. You must respond positively if you want to delete the FF for this food. Otherwise, the residue value for the first FF with a positive value will be entered into the food residue cell.

(If all FF for a given food have the same residue value and processing factor, there is no reason to divide the food into its FF. The resulting analysis will be the same whether or not you use the FF. If a new residue value is assigned to all foods and FF in a file, the FF are not automatically removed. You must remove them manually.)

Note that when you are displaying the residue file data entry grid in the "selected only" mode (that is, only foods with non-zero residues are shown) you may change a food *with FF showing* to a residue value of 0. Right click on the appropriate NFF box to remove the food forms. The grid will be redrawn immediately. This may be confusing temporarily because the food on which you just operated disappears. (However, for foods without expanded FF, setting the residue value to 0 for a food does not make the food disappear in the "selected only" mode until you finish and redisplay the screen in the "selected only" mode.)

NOTE: If a FF for a food is activated (i.e., at least one FF has a non-zero residue value assigned to it) then the residue value shown for the food itself is not actually used in the DEEM™ Chronic or Acute analyses. But the residue values for the food cannot be zero if FF are used. If the residue value of a food is zero, the residue values for all non-zero foodforms also will be zero and the FF for that food will be dropped when the file is displayed the next time or as it is saved.

Adjustment Factors

Typically, the first adjustment factor in the DEEM™ software is used for processing reduction/concentration and the second for usage estimates, both expressed as proportions. The program multiplies the residue value by each of the adjustment factors. The user has the option to exclude adjustment factor #2 from the calculations. Adjustment factors can be copied into contiguous cells using the highlighting method described for residue values.

The default values for the first adjustment factor for each food are retrieved from the DEEM™ database when a new file is created. These default values are provided in Appendix A.

The default value for each FF is the same as for the food itself. The default values for adjustment factor one represent yield losses. Sources for these adjustment factors are USDA Handbook 102 (USDA, 1975) and USDA Commodity Maps (USDA, 1982).

Both of these sources provide information on the quantity of processed foods from a unit amount of whole commodity. The USDA Commodity Maps document specifically lists conversion factors (measures of the physical transformation of a commodity from farm-gate to processing/consumption) for many foods. The conversion factor is the ratio of the weight of the commodity in one form to its weight in another form. The factors reflect gains or losses in a commodity. For example, the conversion factor reported for apple juice is 0.774 pounds per

pound of fresh apples, indicating that one pound of apples converts to 0.774 pounds of apple juice. If residue data are available only for the whole apple, this conversion factor may be used to determine the potential impact on the pesticide residues if treated whole apples are processed to juice. That is, since 1.3 pounds of apples are needed to produce one pound of apple juice, it is assumed that the pesticide level in the RAC apples would concentrate 1.3X in the processed juice (1 ÷ 0.774).

The default adjustment factors in DEEM™ may be considered worst-case because they almost always assume concentration of residues in the processed commodity. The only exception to this is the food soybean sprouts for which the default factor is 0.33, suggesting a weight gain (i.e., reduction in pesticide levels) in the processed commodity.

Conversion information may change over time as a result of the adoption of new technology in both production and processing as well as variation in the physical properties of commodities from one crop year to another. In addition, as new products become available in the market, new conversion factors may be warranted.

One of the major changes in default factors occurred with the release of the 1987/88 Nationwide Food Consumption Survey (NFCS) data. This change was not a result of revisions to conversion factors. Instead, it had to do with the methodology used to translate consumption of milk-containing foods as reported in the survey to those used in the software.

In the 1977/78 NFCS, consumption data for milk products were translated to the foods nonfat solids, fat solids, milk sugar and milk-based water. Consumption of the milk-based water portion was grouped with other food-based waters (water added to food during cooking/preparation). To account for the loss of the fluid component of milk, default factors of 7.87 were assigned to milk fat solids and nonfat solids.

In the development of revised translation factors for the 1987/88 NFCS, milk-based water was kept as a separate ingredient (i.e., not added to other types of water) in the software. Because all milk fractions can be accounted for, the default adjustment factors for milk fat solids and nonfat solids are not necessary. **When evaluating residues in whole milk, all four fractions must be included in the analysis. Depending on the chemical properties of a specific compound, the fractions to be included may be limited to one or a few (e.g., lipophilic compounds where the chemical is found only in the milk fat).**

Comments

The comment (documentation) code can be any combination of alphanumeric characters, with maximum length defined by the size of the data entry field (up to 50 characters). Comment codes can be copied into contiguous cells using the highlighting method described for residue values.

A comment code is not required and is not used in the analyses. This field is valuable in documenting the source of data, or other pertinent information. The comment documentation may be omitted from the residue file report by responding NO in the set up option (Screen 2.1, Chapter 2) of the main menu.

Using the techniques discussed above, add the NOVICHEM tolerance values for apples, celery, cottonseed (meal and oil), grapes, lettuce, peaches/nectarines, strawberries, and tomatoes. Although processing data are available for cooked apples, for this example, the tolerance-value for apples will apply to all apples.

To save the residue file as you are entering the day, you may click on the "Quick Save" box located at the top of the residue file grid. (You will be prompted to save the file after all the data are entered and you exit the Residue Editor Menu.) After the tolerances have been entered for the appropriate foods, click on "Finished." You will return to the "Residue Editor Menu."

Adding Crop Groups

To finish adding the foods and corresponding tolerances for NOVICHEM, click on "Crop Group Actions, then "Add Crop Group." Screen 5.3 will appear.

Screen 5.3 Add Crop Group Screen

If you add all foods for a specified food group using the "add crop group" menu, you must specify a default (non-zero) residue value. If some of the foods and FF in the specified crop group have non-zero residue values (i.e., you already have entered residue values for individual foods), you will be given the option to replace those existing values with the new value or assign the new value to only those foods and FF having a zero value. The residue replacement value is assigned to all foods in the existing crop group and to FF for foods that already have FF specified in the file.

To continue entering NOVICHEM tolerances, click on Crop Group M, Meat. Enter the residue value (0.100 ppm). (Note that the tolerance value for meat liver and byproducts is 0.200 ppm.) You can then change the residue value from 0.100 ppm to 0.200 ppm for liver using the "Add Edit Foods/Foodforms" option.

Since no residues are anticipated in rabbit meat, you can remove rabbit by placing a residue value of 0 ppm in the residue column.

Next, select Crop Group D: Dairy products. Enter the tolerance value for milk (0.05 ppm). Note that all four milk fractions (i.e., nonfat solids, fat solids, lactose, and milk-based water) must be included.

To view the foods in the residue file, click on the option "File" then "Print File with included foods only." You will have the option of printing your file to the screen, a text file, or to paper. Note that, saving your file to a text file simply provides a disk file for reports; this file cannot be used to run the exposure analyses.

To save your file for use in the chronic or acute analysis, click "File," then, "Save."

Your residue file, TOLERANCE7.RS7, should match that presented in Table 5.7

TABLE 5.7

TOLERANCE7 RESIDUE FILE FOR NOVICHEM

Novigen Sciences, Incorporated Ver. 7.06
DEEM Chronic analysis for NOVICHEM 1994-96 data
Residue file: H:\DEEM7 training\tolerance7.RS7 Adjust. #2 used
Analysis Date 02-02-2000 Residue file dated: 02-02-2000/13:33:29/1
Reference dose (RfD) = 0.001 (NOEL) = 1 mg/kg bw/day
Comment:Tolerance-level residues

Food Code	Crop Grp	Food Name	RESIDUE (ppm)	Adj.Factors #1	Adj.Factors #2	Comment
13	O	Grapes	0.050000	1.000	1.000	
14	O	Grapes-raisins	0.050000	4.300	1.000	
15	O	Grapes-juice	0.050000	1.200	1.000	
17	O	Strawberries	0.020000	1.000	1.000	
52	11	Apples	0.035000	1.000	1.000	
53	11	Apples-dried	0.035000	8.000	1.000	
54	11	Apples-juice/cider	0.035000	1.300	1.000	
64	12	Nectarines	1.000000	1.000	1.000	
65	12	Peaches	1.000000	1.000	1.000	
66	12	Peaches-dried	1.000000	7.000	1.000	
159	8	Tomatoes-whole	0.020000	1.000	1.000	
160	8	Tomatoes-juice	0.020000	1.500	1.000	
161	8	Tomatoes-puree	0.020000	3.300	1.000	
162	8	Tomatoes-paste	0.020000	5.400	1.000	
163	8	Tomatoes-catsup	0.020000	2.500	1.000	
166	4B	Celery	0.100000	1.000	1.000	
176	4A	Lettuce-leafy varieties	0.100000	1.000	1.000	
182	4A	Lettuce-unspecified	0.100000	1.000	1.000	
192	4A	Lettuce-head varieties	0.100000	1.000	1.000	
195	O	Grapes-leaves	0.050000	1.000	1.000	
290	O	Cottonseed-oil	0.050000	1.000	1.000	
291	O	Cottonseed-meal	0.050000	1.000	1.000	
315	O	Grapes-wine and sherry	0.050000	1.000	1.000	
318	D	Milk-nonfat solids	0.050000	1.000	1.000	
319	D	Milk-fat solids	0.050000	1.000	1.000	
320	D	Milk sugar (lactose)	0.050000	1.000	1.000	
321	M	Beef-meat byproducts	0.200000	1.000	1.000	
322	M	Beef-other organ meats	0.100000	1.000	1.000	
323	M	Beef-dried	0.100000	1.920	1.000	
324	M	Beef-fat w/o bones	0.100000	1.000	1.000	
325	M	Beef-kidney	0.100000	1.000	1.000	
326	M	Beef-liver	0.200000	1.000	1.000	
327	M	Beef-lean (fat/free) w/o bones	0.100000	1.000	1.000	
328	M	Goat-meat byproducts	0.200000	1.000	1.000	
329	M	Goat-other organ meats	0.100000	1.000	1.000	
330	M	Goat-fat w/o bone	0.100000	1.000	1.000	
331	M	Goat-kidney	0.100000	1.000	1.000	
332	M	Goat-liver	0.200000	1.000	1.000	
333	M	Goat-lean (fat/free) w/o bone	0.100000	1.000	1.000	
334	M	Horsemeat	0.200000	1.000	1.000	
336	M	Sheep-meat byproducts	0.200000	1.000	1.000	
337	M	Sheep-other organ meats	0.100000	1.000	1.000	
338	M	Sheep-fat w/o bone	0.100000	1.000	1.000	
339	M	Sheep-kidney	0.100000	1.000	1.000	
340	M	Sheep-liver	0.200000	1.000	1.000	
341	M	Sheep-lean (fat free) w/o bone	0.100000	1.000	1.000	

TABLE 5.7 (CONT'D)

342	M	Pork-meat byproducts	0.200000	1.000	1.000
343	M	Pork-other organ meats	0.100000	1.000	1.000
344	M	Pork-fat w/o bone	0.100000	1.000	1.000
345	M	Pork-kidney	0.100000	1.000	1.000
346	M	Pork-liver	0.200000	1.000	1.000
347	M	Pork-lean (fat free) w/o bone	0.100000	1.000	1.000
377	11	Apples-juice-concentrate	0.035000	3.900	1.000
384	4B	Celery juice	0.100000	1.000	1.000
392	O	Grapes-juice-concentrate	0.050000	3.600	1.000
398	D	Milk-based water	0.050000	1.000	1.000
402	12	Peaches-juice	1.000000	1.000	1.000
416	O	Strawberries-juice	0.020000	1.000	1.000
423	8	Tomatoes-dried	0.020000	14.300	1.000
424	M	Veal-fat w/o bones	0.100000	1.000	1.000
425	M	Veal-lean (fat free) w/o bones	0.100000	1.000	1.000
426	M	Veal-kidney	0.100000	1.000	1.000
427	M	Veal-liver	0.200000	1.000	1.000
428	M	Veal-other organ meats	0.100000	1.000	1.000
429	M	Veal-dried	0.100000	1.920	1.000
430	M	Veal-meat byproducts	0.200000	1.000	1.000

Closing the Residue File

To create another residue file or to return to the main DEEM™ menu you must close the current residue file.

Creating A New Residue File Using a Previously Created Residue File

Next, using the anticipated residue values for NOVICHEM, we will create the CHRONIC7.RS7 residue file (Table 5.8). First, save the TOLERANCE7.RS7 file as "CHRONIC7.RS7." (Note that you will need to open the file if it is closed.) Change the tolerance residue values to the mean residue values listed in Table 5.5. Since, processing data for washed and cooked apples are available, you will need to expand the RAC apple to its FF. Add the appropriate processing factors in the column labeled Adjustment Factor #1; add the percent of crop treated (as a proportion; 25% is entered as 0.25) information (Table 5.6) in the column labeled Adjustment Factor #2. Use the source column to identify the residue level (e.g., tolerance or mean) assigned to each food/foodform. Both residue files created here will be used in Chapter 6, *Chronic Exposure Analysis Including Commodity Contribution Analysis*, to conduct chronic exposure assessments for NOVICHEM.

TABLE 5.8

CHRONIC7 RESIDUE FILE FOR NOVICHEM

Novigen Sciences, Incorporated Ver. 7.02
DEEM Chronic analysis for NOVICHEM 1994-96 data
Residue file: C:\DEEM manual\chronic7.RS7 Adjust. #2 NOT used
Analysis Date 02-06-2000 Residue file dated: 02-03-2000/15:35:04/1
Reference dose (RfD) = 0.001 (NOEL) = 1 mg/kg bw/day
Comment:Anticipated residues

Food Code	Crop Grp	Food Name	RESIDUE (ppm)	Adj.Factors #1	Adj.Factors #2
13	O	Grapes	0.003000	1.000	1.000
14	O	Grapes-raisins	0.003000	1.000	1.000
15	O	Grapes-juice	0.003000	0.060	1.000
17	O	Strawberries	0.007000	1.000	1.000
52	11	Apples			
		11-Uncooked	0.004000	0.200	0.100
		12-Cooked: NFS	0.004000	0.050	0.100
		13-Baked	0.004000	0.050	0.100
		14-Boiled	0.004000	0.050	0.100
		15-Fried	0.004000	0.050	0.100
		18-Dried	0.004000	0.200	0.100
		31-Canned: NFS	0.004000	0.050	0.100
		32-Canned: Cooked	0.004000	0.050	0.100
		33-Canned: Baked	0.004000	0.050	0.100
		34-Canned: Boiled	0.004000	0.050	0.100
		42-Frozen: Cooked	0.004000	0.050	0.100
53	11	Apples-dried	0.004000	8.000	0.100
54	11	Apples-juice/cider	0.004000	0.020	0.100
64	12	Nectarines	0.040000	1.000	0.100
65	12	Peaches	0.040000	1.000	0.100
66	12	Peaches-dried	0.040000	7.000	0.100
159	8	Tomatoes-whole	0.004000	1.000	1.000
160	8	Tomatoes-juice	0.004000	0.020	1.000
161	8	Tomatoes-puree	0.004000	0.020	1.000
162	8	Tomatoes-paste	0.004000	0.500	1.000
163	8	Tomatoes-catsup	0.004000	0.020	1.000
166	4B	Celery	0.012000	1.000	0.250
176	4A	Lettuce-leafy varieties	0.100000	1.000	0.100
182	4A	Lettuce-unspecified	0.100000	1.000	0.100
192	4A	Lettuce-head varieties	0.100000	1.000	0.100
195	O	Grapes-leaves	0.003000	1.000	1.000
290	O	Cottonseed-oil	0.005000	0.010	1.000
291	O	Cottonseed-meal	0.005000	0.020	1.000
315	O	Grapes-wine and sherry	0.003000	1.000	1.000
318	D	Milk-nonfat solids	0.005000	1.000	1.000
319	D	Milk-fat solids	0.005000	1.000	1.000
320	D	Milk sugar (lactose)	0.005000	1.000	1.000
321	M	Beef-meat byproducts	0.200000	1.000	1.000
322	M	Beef-other organ meats	0.100000	1.000	1.000
323	M	Beef-dried	0.100000	1.920	1.000
324	M	Beef-fat w/o bones	0.100000	1.000	1.000
325	M	Beef-kidney	0.100000	1.000	1.000
326	M	Beef-liver	0.200000	1.000	1.000
327	M	Beef-lean (fat/free) w/o bones	0.100000	1.000	1.000
328	M	Goat-meat byproducts	0.200000	1.000	1.000
329	M	Goat-other organ meats	0.100000	1.000	1.000
330	M	Goat-fat w/o bone	0.100000	1.000	1.000
331	M	Goat-kidney	0.100000	1.000	1.000
332	M	Goat-liver	0.200000	1.000	1.000
333	M	Goat-lean (fat/free) w/o bone	0.100000	1.000	1.000

TABLE 5.8 (CONT'D)

334	M	Horsemeat	0.100000	1.000	1.000
336	M	Sheep-meat byproducts	0.200000	1.000	1.000
337	M	Sheep-other organ meats	0.100000	1.000	1.000
338	M	Sheep-fat w/o bone	0.100000	1.000	1.000
339	M	Sheep-kidney	0.100000	1.000	1.000
340	M	Sheep-liver	0.200000	1.000	1.000
341	M	Sheep-lean (fat free) w/o bone	0.100000	1.000	1.000
342	M	Pork-meat byproducts	0.200000	1.000	1.000
343	M	Pork-other organ meats	0.100000	1.000	1.000
344	M	Pork-fat w/o bone	0.100000	1.000	1.000
345	M	Pork-kidney	0.100000	1.000	1.000
346	M	Pork-liver	0.200000	1.000	1.000
347	M	Pork-lean (fat free) w/o bone	0.100000	1.000	1.000
377	11	Apples-juice-concentrate	0.004000	0.060	0.100
384	4B	Celery juice	0.012000	1.000	0.250
392	O	Grapes-juice-concentrate	0.003000	0.180	1.000
398	D	Milk-based water	0.005000	1.000	1.000
402	12	Peaches-juice	0.040000	1.000	0.100
416	O	Strawberries-juice	0.007000	1.000	1.000
423	8	Tomatoes-dried	0.004000	14.300	1.000
424	M	Veal-fat w/o bones	0.100000	1.000	1.000
425	M	Veal-lean (fat free) w/o bones	0.100000	1.000	1.000
426	M	Veal-kidney	0.100000	1.000	1.000
427	M	Veal-liver	0.200000	1.000	1.000
428	M	Veal-other organ meats	0.100000	1.000	1.000
429	M	Veal-dried	0.100000	1.920	1.000
430	M	Veal-meat byproducts	0.200000	1.000	1.000

Building Residue Files for the Acute Analysis

To create the ACUTE NOVICHEM residue file (Table 5.9), save the TOLERANCE7 file under the name ACUTE7.RS7. Enter the mean residue value (Table 5.5) for the following blended foods[1]:

- cottonseed meal/oil
- milk

Convert the tolerance values to the highest average field trial value (HAFT) (Table 5.5) for the following foods:

- apples
- grapes
- celery
- peaches/nectarines
- strawberries
- tomatoes

Include the appropriate processing factors in the column labeled "Adjustment Factor #1." Since residue data are not available for meat and lettuce, use the tolerance values.

[1] EPA definitions for not blended, partially blended, and blended commodities currently are under review. See EPA SOP 99.6. Classification of Food Forms with Respect to Levels of Blending. August 20, 1999.

TABLE 5.9

ACUTE7 RESIDUE FILE FOR NOVICHEM

Novigen Sciences, Incorporated Ver. 7.06
DEEM Acute analysis for NOVICHEM
Residue file name: H:\DEEM7 training\acute7.RS7
Analysis Date 02-02-2000 Residue file dated: 02-02-2000/13:35:32/1
Reference dose: aRfD = 0.0025 mg/kg bw/day NOEL = 0.25 mg/kg bw/day
Comment: Anticipated residues

Food Code	Crop Grp	Food Name	Def Res (ppm)	Adj.Factors #1	#2	Comment
13	O	Grapes	0.025000	1.000	1.000	
14	O	Grapes-raisins	0.025000	1.000	1.000	
15	O	Grapes-juice	0.025000	0.060	1.000	
17	O	Strawberries	0.014000	1.000	1.000	
52	11	Apples				
		11-Uncooked	0.020000	0.200	1.000	
		12-Cooked: NFS	0.020000	0.050	1.000	
		13-Baked	0.020000	0.050	1.000	
		14-Boiled	0.020000	0.050	1.000	
		15-Fried	0.020000	0.050	1.000	
		18-Dried	0.020000	0.200	1.000	
		31-Canned: NFS	0.020000	0.050	1.000	
		32-Canned: Cooked	0.020000	0.050	1.000	
		33-Canned: Baked	0.020000	0.050	1.000	
		34-Canned: Boiled	0.020000	0.050	1.000	
		42-Frozen: Cooked	0.020000	0.050	1.000	
53	11	Apples-dried	0.020000	8.000	1.000	
54	11	Apples-juice/cider	0.020000	0.020	1.000	
64	12	Nectarines	0.600000	1.000	1.000	
65	12	Peaches	0.600000	1.000	1.000	
66	12	Peaches-dried	0.600000	7.000	1.000	
159	8	Tomatoes-whole	0.011000	1.000	1.000	
160	8	Tomatoes-juice	0.011000	0.020	1.000	
161	8	Tomatoes-puree	0.011000	0.020	1.000	
162	8	Tomatoes-paste	0.011000	0.500	1.000	
163	8	Tomatoes-catsup	0.011000	0.020	1.000	
166	4B	Celery	0.070000	1.000	1.000	
176	4A	Lettuce-leafy varieties	0.100000	1.000	1.000	
182	4A	Lettuce-unspecified	0.100000	1.000	1.000	
192	4A	Lettuce-head varieties	0.100000	1.000	1.000	
195	O	Grapes-leaves	0.025000	1.000	1.000	
290	O	Cottonseed-oil	0.005000	0.010	1.000	
291	O	Cottonseed-meal	0.005000	0.020	1.000	
315	O	Grapes-wine and sherry	0.025000	1.000	1.000	
318	D	Milk-nonfat solids	0.005000	1.000	1.000	
319	D	Milk-fat solids	0.005000	1.000	1.000	
320	D	Milk sugar (lactose)	0.005000	1.000	1.000	
321	M	Beef-meat byproducts	0.200000	1.000	1.000	
322	M	Beef-other organ meats	0.100000	1.000	1.000	
323	M	Beef-dried	0.100000	1.920	1.000	
324	M	Beef-fat w/o bones	0.100000	1.000	1.000	
325	M	Beef-kidney	0.100000	1.000	1.000	
326	M	Beef-liver	0.200000	1.000	1.000	
327	M	Beef-lean (fat/free) w/o bones	0.100000	1.000	1.000	
328	M	Goat-meat byproducts	0.200000	1.000	1.000	
329	M	Goat-other organ meats	0.100000	1.000	1.000	
330	M	Goat-fat w/o bone	0.100000	1.000	1.000	
331	M	Goat-kidney	0.100000	1.000	1.000	
332	M	Goat-liver	0.200000	1.000	1.000	
333	M	Goat-lean (fat/free) w/o bone	0.100000	1.000	1.000	
334	M	Horsemeat	0.200000	1.000	1.000	

TABLE 5.9 (CONT'D)

336	M	Sheep-meat byproducts	0.200000	1.000	1.000
337	M	Sheep-other organ meats	0.100000	1.000	1.000
338	M	Sheep-fat w/o bone	0.100000	1.000	1.000
339	M	Sheep-kidney	0.100000	1.000	1.000
340	M	Sheep-liver	0.200000	1.000	1.000
341	M	Sheep-lean (fat free) w/o bone	0.100000	1.000	1.000
342	M	Pork-meat byproducts	0.200000	1.000	1.000
343	M	Pork-other organ meats	0.100000	1.000	1.000
344	M	Pork-fat w/o bone	0.100000	1.000	1.000
345	M	Pork-kidney	0.100000	1.000	1.000
346	M	Pork-liver	0.200000	1.000	1.000
347	M	Pork-lean (fat free) w/o bone	0.100000	1.000	1.000
377	11	Apples-juice-concentrate	0.020000	0.060	1.000
384	4B	Celery juice	0.070000	1.000	1.000
392	O	Grapes-juice-concentrate	0.025000	0.180	1.000
398	D	Milk-based water	0.005000	1.000	1.000
402	12	Peaches-juice	0.600000	1.000	1.000
416	O	Strawberries-juice	0.014000	1.000	1.000
423	8	Tomatoes-dried	0.011000	14.300	1.000
424	M	Veal-fat w/o bones	0.100000	1.000	1.000
425	M	Veal-lean (fat free) w/o bones	0.100000	1.000	1.000
426	M	Veal-kidney	0.100000	1.000	1.000
427	M	Veal-liver	0.200000	1.000	1.000
428	M	Veal-other organ meats	0.100000	1.000	1.000
429	M	Veal-dried	0.100000	1.920	1.000
430	M	Veal-meat byproducts	0.200000	1.000	1.000

The ACUTE7.RS7 file will be used in the acute analyses for NOVICHEM (Chapter 7, *Acute Exposure Analysis*).

Once the files have been created (and saved), close the current file and exit to the main menu.

Other Residue File Formats: The Acute and Chronic Modules and Residue File Editor include the ability to read *.R96 residue files created DEEM™ program versions prior to version 7. The program Convert96.exe, included in the DEEM program directory, converts DEEM™ residue files that have the following extensions to R96 files:

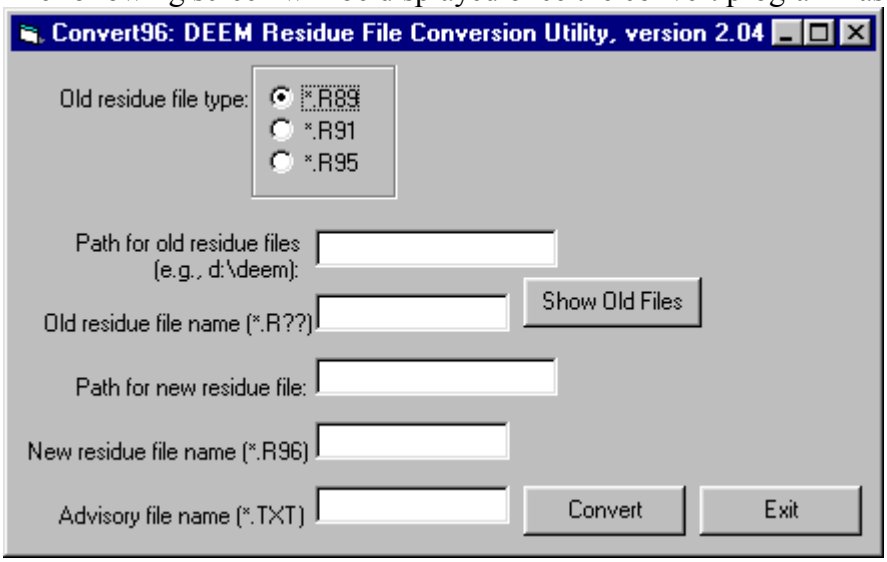
*.R89 (for DEEM89T files based on TAS recipes and the 1989 through 1992 CSFII consumption data),
*.R91 (for DEEM89N files based on Novigen translation factors and the 1989 through 1992 CSFII consumption data), and
*.R95 (for DEEM96 files based on Novigen translation factors for the 1994 through1996 CSFII BEFORE the survey data were completed)

The process of converting these older residue files using the Convert96 utility includes: (1) updating the internal validation code to the code needed for R96 files; (2) omitting FF indices at the beginning of each line of FF data (these had been unique for each survey year; they are no longer needed); and (3) for those RACs with foodforms listed, converting each foodform code in the old file that no longer exists in the new file format using a "map" file specific to the conversion year (1989, 1991, 1995).

The analyst must be aware that the FF conversion may raise some problems. Specifically, if two FF in an earlier version of the residue file each have a different residue and/or RDF[2] file pointer, and are converted to the same new FF, then some information will be lost. The conversion rule used in this case is that the FF with the highest residue value is carried over to the new FF, along with its RDF file pointer. When multiple FF with different residue amounts or RDF pointers are collapsed, an advisory report is generated ("*.txt"). The advisory report identifies the RAC/FF combinations that have been dropped or changed. This file is assigned the default name of the residue file to be converted and is saved to the same directory as the R96 file. The user has the option to change the path and or name of the advisory file.

An R96 file generated by the Convert96 program will be slightly different than an R96 file generated or edited by the DEEM™ residue file editor. For example, the converted file lists only those FF that have nonzero residues and/or RDF file pointers. The file saved by the DEEM™ residue file editor will list all foodforms for a given RAC, regardless of the residue value or RDF pointer. You must load and SAVE the converted residue file (R96) into the DEEM™ file editor to review the file to confirm that the data have been faithfully converted to the new format. Failing to save the converted file may result in program errors when the file is used in an analysis.

The following screen will be displayed once the convert program has been accessed.



Screen 5.4: Convert Utility

[2] RDF = Residue Distribution File used in acute Monte Carlo Analysis (Chapter 7).

Running the utility requires the following steps.

(1) Specify the type of file to be converted (R89, R91, or R95).
(2) Specify the path of the existing residue file.
(3) Either specify the name of the existing residue file or click on the "Show Old Files" button. If you use the latter method, a dialog box will appear showing the available files in the designated path. You can change directories if you wish; if you do so, the path for the old file will be updated when you select the file to be converted. If you use the dialog box method of selecting a file to be converted, the filename of the new file will be automatically entered in the appropriate box. You can edit this new file name if you want to save it under a different name.
(4) Specify the path for saving the new file.
(5) If the filename of the new file is not already in the last data field (see step 3) then you must enter the filename here. If you do not include the filename extension it will be entered automatically. If you do enter a filename extension, it must be "R96."
(6) Enter the name of the advisory file. The program automatically assigns the residue file name (with a TXT extension); you may change the name of the file.
(7) Click on the "Convert" button to generate the new file. You will get a confirmation message that the file conversion is complete.
(8) Click on exit to close this utility.

The advisory file lists all RAC/foodform conversions that were changed or deleted from the converted file. Some of the previous RACs have been changed because of changes in the Novigen translation factors. Some conversions have asterisks at the right side of the RAC name; these should be examined carefully before you accept the conversion results.

Changes in the translation factors that have been used by Novigen to convert the foods reported "as eaten" to their constituent ingredients (i.e., RACs) have occurred over time. In addition, previous DEEM™ residue files were specific to a single CSFII. Thus, there is not a one-to-one correspondence between all of the available RAC/FF combinations in previous residue files and R96 residue files.

RAC/FF combinations that have a non-zero residue value and/or a non-zero RDF pointer in the previous file and that are available in the R96 RAC/FF database are directly converted from the old file to the new (along with the corresponding residue value, RDF pointer, adjustment values, and documentation, if any). These parameters always take precedence in the conversion process over parameters for food forms that must be converted to another food form code. RAC/FF combinations in the previous file that do not have an available counterpart in the R96 RAC/FF database are converted using a "map" file provided with the Convert96 program.

For example, RAC 5 has six food forms in the R96 database: 11, 13, 14, 31, 34, and 41. In a previous residue file there were residue data for FF 13, 14, and 15. RAC5/FF15 is to be converted to RAC5/FF14 (based on the map file). The program would convert RAC5/FF15 to RAC5/FF14; however, its residue value would be dropped, since the residue value and RDF pointer, etc., for RAC5/FF14 are taken directly from this RAC/FF combination in the previous file. RAC5/FF15 would be reported in the advisory file as having been changed to RAC5/FF14.

If one or more RAC/FF combinations in a previous residue file are translated to a common RAC/FF combination in the R96 file (based on translation data in the map file), and there is no RAC/FF combination in the older file that matches this common RAC/FF combination, then the highest residue value for any such RAC/FF combination brought over is used with the new RAC/FF combination, along with its RDF pointer, adjustment factors, and documentation. Extending the example above for RAC 5, if FF32 and FF33 are to be converted to FF31 and FF31 was not included in the older file, then FF31 would be included in the new file along with the residue value (and the RDF pointer, etc.) from either FF32 or FF33, whichever residue value is higher (not on which RDF pointer value is higher). All of these converted RAC/FF combinations will be reported in the advisory file.

Note: the map file may specify that some RAC/FF combinations that do not have a direct counterpart in the R96 file could not be converted. RAC/FF combinations that are not converted also will be reported in the advisory file.

Converting residue file formats to RS7 files: It is possible to edit a R96 file directly in the residue file editor of DEEM 7. Once edited, the file will be saved in the RS7 format. To utilize R89, R91 or R95 files in DEEM™ 7.0, you must first convert them to a R96 file. (Note that R96 files may be used directly in DEEM™ 7.0 analyses, without saving as a RS7 file).

CHAPTER 6. CHRONIC EXPOSURE ANALYSIS INCLUDING COMMODITY CONTRIBUTION ANALYSIS

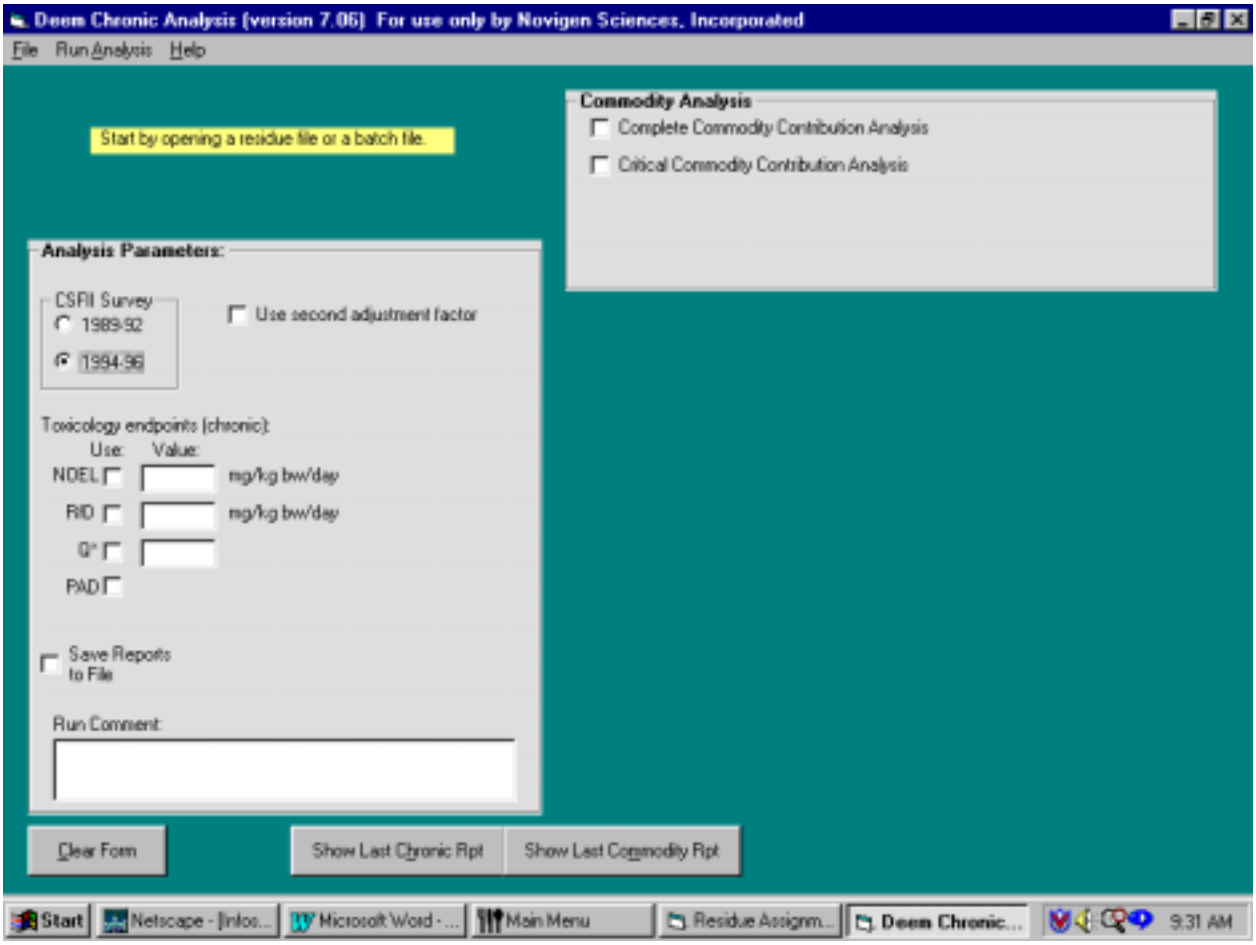
The Chronic Analysis Option of DEEM™ can be used to estimate total exposure for the US population and 25 (1994/96 CSFII) or 26 (1989/92 CSFII) subgroups of the population. Subgroups are divided by regions of the country or seasons of the year, age, gender, or ethnicity. (See Appendix B for a breakdown of the geographical regions and seasons.)

The Commodity Contribution Analysis, explained in more detail below, can be used to identify the contribution of individual foods (and foodforms) to the overall estimate of dietary exposure.

Each DEEM™ analysis requires two data sets (1) mean food consumption files and (2) residue analysis files. The food consumption files are already included in DEEM™ and are a fixed data set that cannot be altered. The user must create a residue file for the chemical of interest. Residue analysis files are created by procedures described in Chapter 5 and by following the on-screen instructions.

NOTE: A residue analysis file must be created and saved prior to conducting an exposure analysis.

At the DEEM™ Main Menu Screen, click on "Analysis" then "Run Chronic." You will then be prompted for your password. After the password has been entered correctly, Screen 6.1 will appear:



Screen 6.1: Chronic Analysis Window

Select the file to be analyzed by clicking on “File” then “Open Residue File.”

You then will be given a listing of the available files. Note that you may select files from directories other than the default established through the SETUP option (Chapter 2).

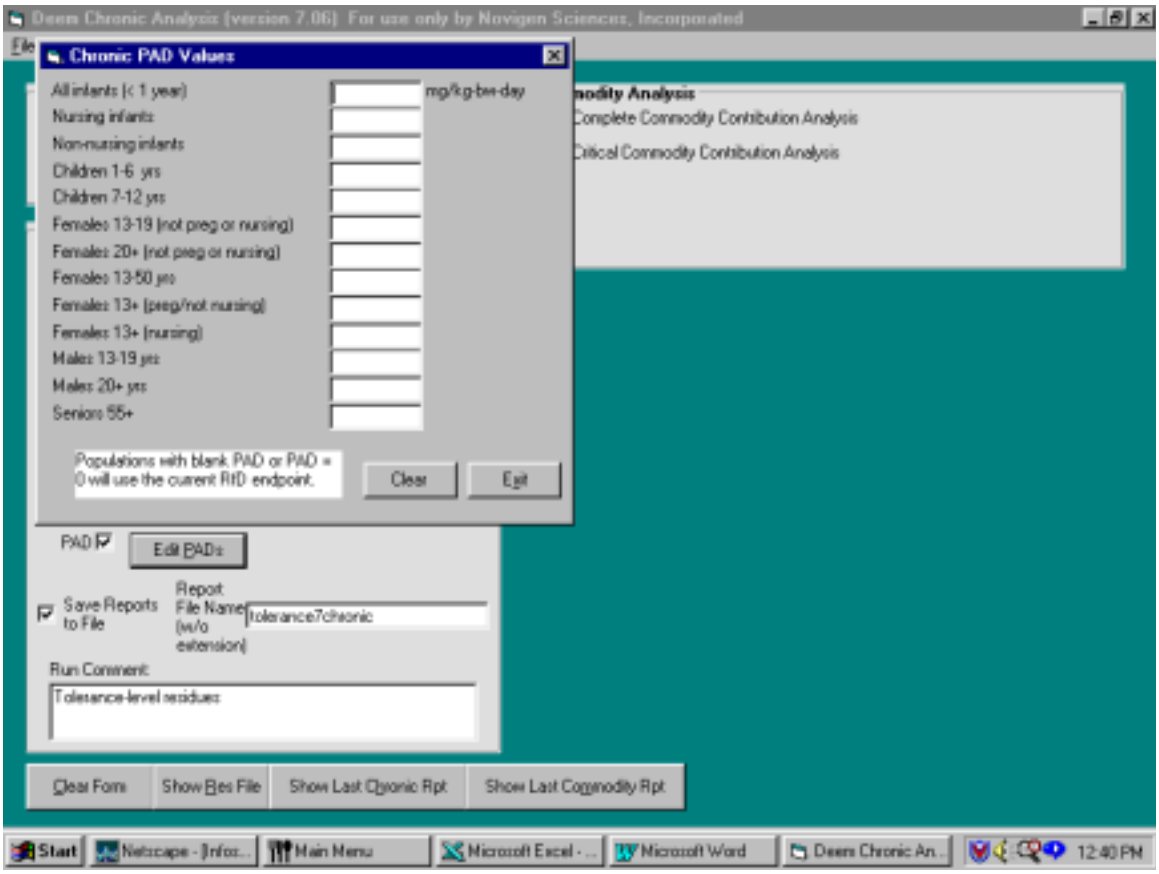
Highlight the file to be used in the current analysis and click “Open.” The file characteristics (e.g., date created, directory location, etc.) will be displayed under the heading ‘Residue File’ in the Chronic Analysis Window.

You will have the option of using the 1989/92 CSFII or 1994/96 CSFII data for the analysis. In addition, you will have the option of including the second adjustment factor in the calculations.

You also will be given the option of comparing the exposure results (expressed as mg chemical/kg bw/day) to the chronic RfD, chronic NOEL, both, or to the Q1*. Exposure estimates will be expressed as a percent of the RfD; selecting the NOEL will produce Margins of Exposure. Chronic exposure estimates compared to a Q* value will be expressed as a lifetime

cancer risk. At this point, you will have the opportunity to change any of the toxicological endpoints identified in the file; however, the value will be changed for the current analysis only. To change the RfD value permanently, use the Edit Header option in the Residue File Editor.

To compare exposure to a chronic Population Adjusted Dose (cPAD), select Edit PAD button. A window will appear with a list of population subgroups (Screen 6.2).



Screen 6.2: Chronic Analysis Window – PAD entry window

Enter the appropriate cPAD for the population groups of interest, then click Exit.

To save the chronic analysis report to a file, select Save Reports to File option. You must then enter a file name for the report. (Note that you will be given another opportunity to save the report to a file by clicking on Show Last Chronic Rpt, described below.)

In the Run Comment field, comments entered in the Edit Header field in the Residue File Builder are shown. You may enter additional comments that will appear on the DEEM™ reports. Note that any additional comments will appear in the reports generated from this analysis only. If you wish to change the initial comment, you must return to the Residue File Editor.

You may view or obtain a hard copy of the residue data used in your analysis by checking the "Show Res File" button. You will then be prompted to display the report to screen, save to disk, send directly to printer or cancel the action.

DEEM™ saves the chronic analysis as a temporary file. Each time the program is accessed, results from the last analysis will be available for viewing. Once an analysis is run, this previously conducted analysis will be replaced with the current one. The "Show Last Chronic Rpt" button permits the user to display, save, or print the analysis report. If you wish to send the file to the printer, make sure that your printer is on line.

If you select to save a report to *disk*, you will be prompted to enter a file name.

We will use the TOLERANCE7.RS7 residue file created in Chapter 5 to conduct a chronic exposure analysis. Using consumption data from the 1994/1996 CSFII, Table 6.1 presents the resulting exposure analysis. Repeat the same procedures using the CHRONIC7.RS7 file created in Chapter 5 to obtain an exposure analysis for NOVICHEM using anticipated residues (again, with the 1994/1996 CSFII data). The results of the second analysis are shown in Table 6.2

TABLE 6.1

CHRONIC DIETARY EXPOSURE ESTIMATES FOR NOVICHEM USING TOLERANCES

Novigen Sciences, Incorporated Ver. 7.06
DEEM Chronic analysis for NOVICHEM (1994-96 data)
Residue file name: H:\DEEM7 training\tolerance7.RS7
Adjustment factor #2 used.
Analysis Date 02-02-2000/14:07:54 Residue file dated: 02-02-2000/13:33:29/1
Reference dose (RfD, Chronic) = .001 mg/kg bw/day
NOEL (Chronic) = 1 mg/kg bw/day
COMMENT 1: Tolerance-level residues

Total exposure by population subgroup

Population Subgroup	Total Exposure mg/kg body wt/day	Margin of Exposure 1/	Percent of PAD
U.S. Population (total)	0.000754	1,325	75.4%
U.S. Population (spring season)	0.000735	1,361	73.5%
U.S. Population (summer season)	0.000836	1,197	83.6%
U.S. Population (autumn season)	0.000733	1,365	73.3%
U.S. Population (winter season)	0.000713	1,403	71.3%
Northeast region	0.000770	1,299	77.0%
Midwest region	0.000786	1,272	78.6%
Southern region	0.000691	1,447	69.1%
Western region	0.000808	1,238	80.8%
Hispanics	0.000874	1,144	87.4%
Non-hispanic whites	0.000741	1,350	74.1%
Non-hispanic blacks	0.000718	1,392	71.8%
Non-hisp/non-white/non-black	0.000795	1,257	79.5%
All infants (< 1 year) (.0003*)	**0.001804**	**554**	**601.4%**
Nursing infants	0.000693	1,443	69.3%
Non-nursing infants	0.002129	470	212.9%
Children 1-6 yrs	0.002424	412	242.4%
Children 7-12 yrs	0.001179	849	117.9%
Females 13-19 (not preg or nursing)	0.000562	1,779	56.2%
Females 20+ (not preg or nursing)	0.000458	2,185	45.8%
Females 13-50 yrs	0.000476	2,102	47.6%
Females 13+ (preg/not nursing)	0.000732	1,366	73.2%
Females 13+ (nursing)	0.000683	1,464	68.3%
Males 13-19 yrs	0.000657	1,523	65.7%
Males 20+ yrs	0.000488	2,047	48.8%
Seniors 55+	0.000494	2,023	49.4%

*PAD in mg/kg-bw-day

TABLE 6.2

CHRONIC DIETARY EXPOSURE ESTIMATES FOR NOVICHEM USING ANTICIPATED RESIDUES

Novigen Sciences, Incorporated Ver. 7.06
DEEM Chronic analysis for NOVICHEM (1994-96 data)
Residue file name: H:\DEEM7 training\chronic7.RS7 Adjustment factor #2 used.
Analysis Date 02-03-2000/15:35:50 Residue file dated: 02-03-2000/15:35:04/1
Reference dose (RfD, Chronic) = .001 mg/kg bw/day
NOEL (Chronic) = 1 mg/kg bw/day
COMMENT 1: Anticipated residues

Total exposure by population subgroup

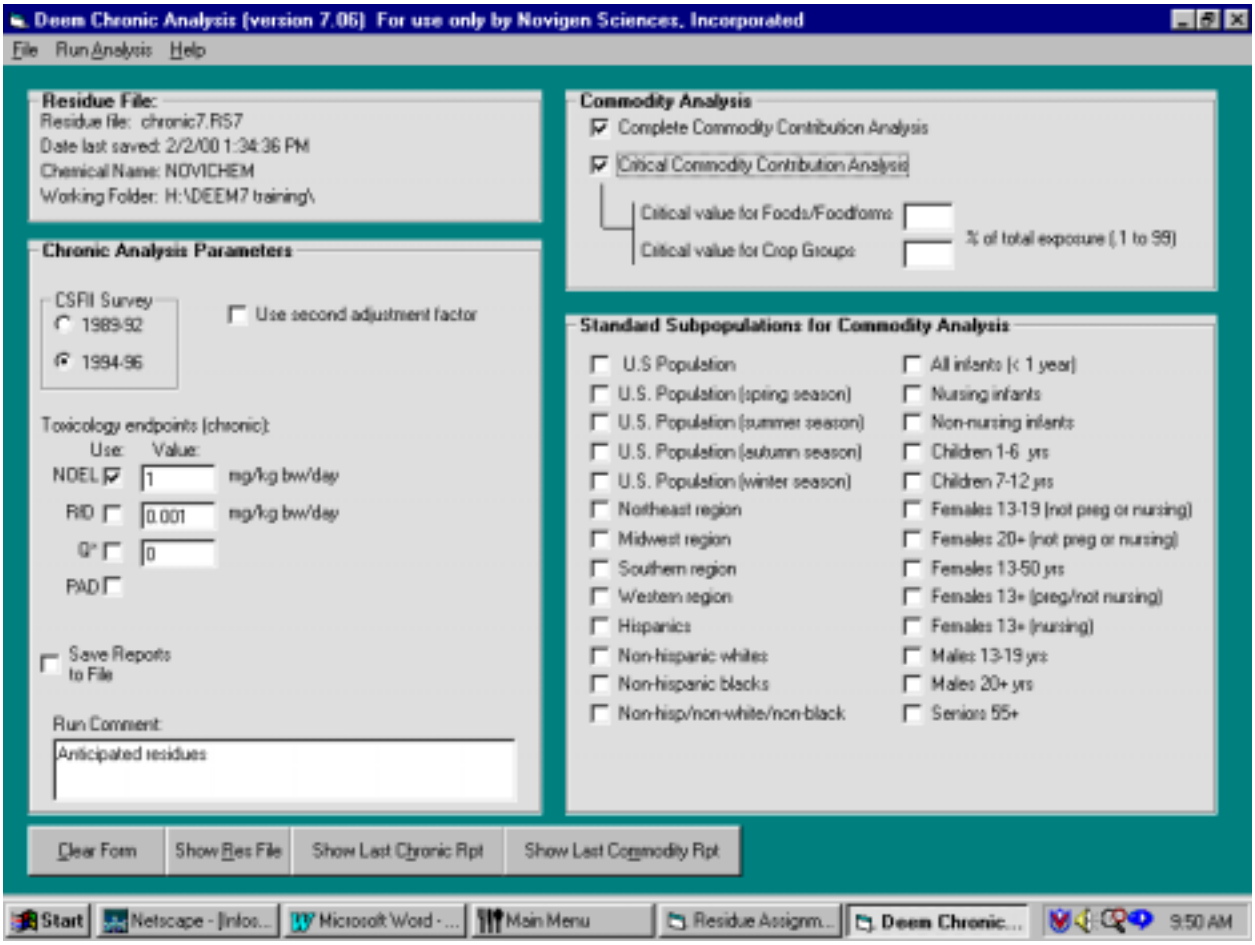
Population Subgroup	Total Exposure mg/kg body wt/day	Total Exposure Margin of Exposure 1/	Total Exposure Percent of PAD
U.S. Population (total)	0.000178	5,608	17.8%
U.S. Population (spring season)	0.000177	5,638	17.7%
U.S. Population (summer season)	0.000181	5,520	18.1%
U.S. Population (autumn season)	0.000181	5,510	18.1%
U.S. Population (winter season)	0.000173	5,788	17.3%
Northeast region	0.000170	5,872	17.0%
Midwest region	0.000195	5,121	19.5%
Southern region	0.000171	5,838	17.1%
Western region	0.000179	5,601	17.9%
Hispanics	0.000202	4,961	20.2%
Non-hispanic whites	0.000169	5,922	16.9%
Non-hispanic blacks	0.000205	4,886	20.5%
Non-hisp/non-white/non-black	0.000204	4,898	20.4%
All infants (< 1 year) (.0003*)	**0.000117**	**8,575**	**38.9%**
Nursing infants	0.000024	41,387	2.4%
Non-nursing infants	0.000144	6,960	14.4%
Children 1-6 yrs	0.000402	2,487	40.2%
Children 7-12 yrs	0.000259	3,855	25.9%
Females 13-19 (not preg or nursing)	0.000145	6,874	14.5%
Females 20+ (not preg or nursing)	0.000115	8,696	11.5%
Females 13-50 yrs	0.000126	7,940	12.6%
Females 13+ (preg/not nursing)	0.000158	6,318	15.8%
Females 13+ (nursing)	0.000149	6,699	14.9%
Males 13-19 yrs	0.000212	4,711	21.2%
Males 20+ yrs	0.000164	6,080	16.4%
Seniors 55+	0.000120	8,346	12.0%

*PAD in mg/kg-bw-day

The exposure estimate is the sum of exposure due to residues in each food. The DEEM™ chronic module allows you to determine each food and FF contribution to the overall estimate. These analyses are called COMMODITY CONTRIBUTION ANALYSES and are discussed below.

The COMMODITY CONTRIBUTION ANALYSIS option determines the contribution of individual foods, FF and crop groups to the exposure estimate. The COMMODITY CONTRIBUTION ANALYSIS is a powerful tool for focusing future research, development and regulatory strategies.

You may elect to conduct a COMMODITY CONTRIBUTION ANALYSIS clicking on one (or both) of the two options available on the Chronic Analysis Screen (Screen 6.3).



Screen 6.3 Chronic Analysis Window (with Commodity Analysis Highlighted)

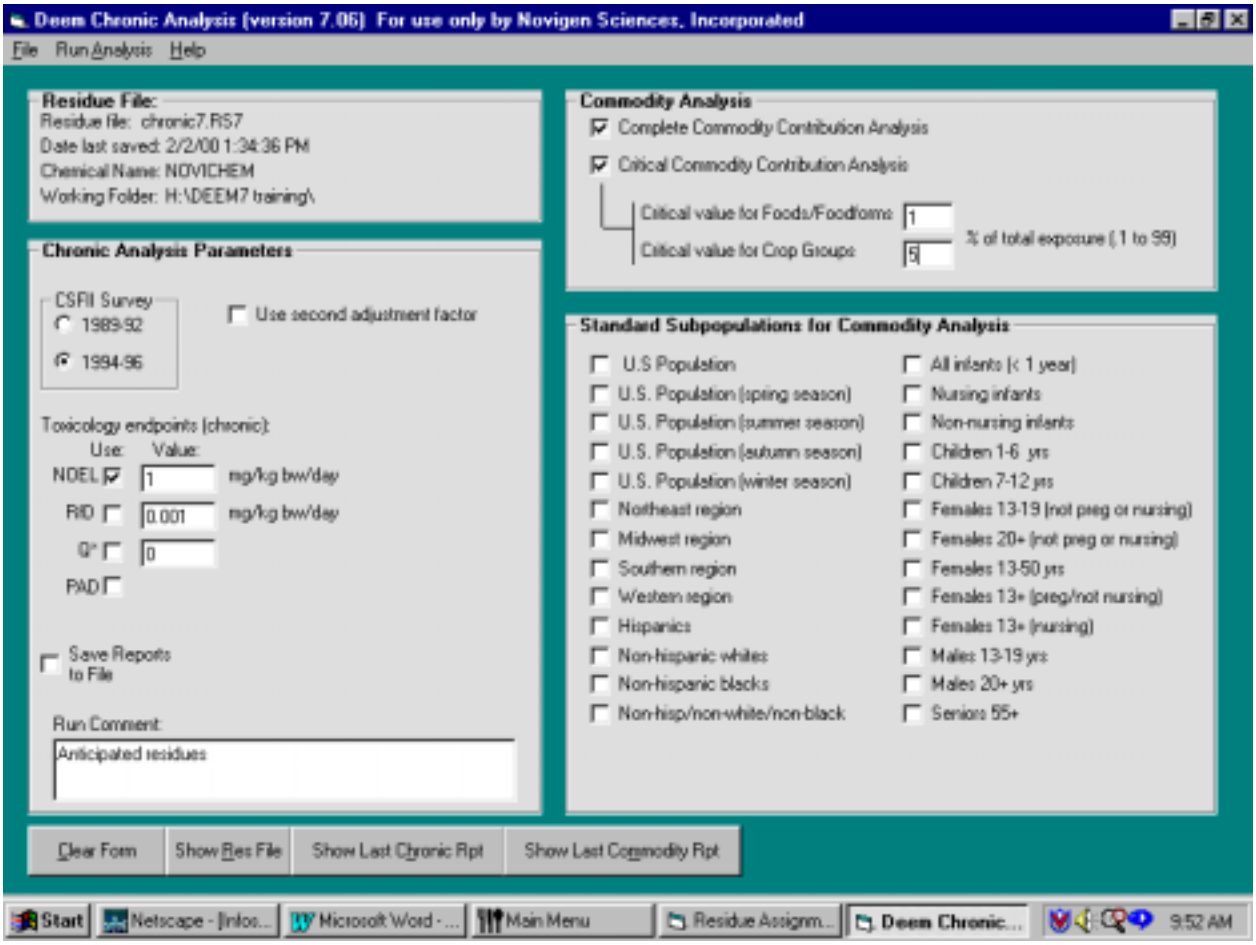
1. Complete Commodity Analysis

   The Complete Commodity Analysis reports the contribution of every commodity, expressed both as mg chemical/kg bw/day and as a percent of the Reference Dose (RfD) or PAD, or lifetime cancer risk, or MOE.

2. Critical Commodity Analysis

   The critical commodity analysis reports the exposure from those foods that contribute a user-specified proportion of the overall exposure, e.g., 1% of total exposure. The critical commodity listing is expressed as both a percent of the RfD (or PAD, or lifetime cancer risk, or MOE) and as a percent of total exposure.

Population subgroups for which commodity contribution analyses are desired are selected by clicking on the population of interest. If you request a critical commodity analysis, you must also specify the criteria for inclusion in the analysis, i.e., those foods that contribute at least X% of the total exposure (Screen 6.4).



Screen 6.4 Critical Commodity Contribution Analysis Options

NOTE: The criteria for including foods and crop groups in the critical commodity analysis may be different. For example, include those foods or FF that contribute at least 1% of exposure but only those crop groups which contribute at least 5% of exposure and for which no individual food contributes at least 1% of total exposure.

To view the analysis, click on Show Last Commodity Rpt at the bottom of the screen. You will be given the option of viewing the report, sending it to a printer, or saving it to a disk file. Like the chronic analysis report, DEEM™ will store the commodity report as a temporary file and will replace the file each time an analysis is conducted. The user may save the report to file by selecting Save Reports to File prior to conducting the analysis.

When you've completed the commodity contribution analysis for all of the subgroups of interest, you may exit the window by clicking on "File" then "Exit."

We will use the commodity contribution analysis to complete our chronic analysis of NOVICHEM by conducting both a complete commodity contribution analysis and a critical commodity contribution analysis for the overall US population. For the example, we will use the TOLERANCE7.RS7 residue file constructed in Chapter 5. The chronic exposure analysis for TOLERANCE7.RS7 is shown in Table 6.1. We will limit our critical commodity analysis to those foods that are greater than 1% of total exposure, and to those crop groups whose member foods contribute at least 5% of total exposure.

Table 6.3 presents the resulting critical commodity contribution analysis for the overall US population. The complete commodity contribution analysis for the US Population is shown in Table 6.4.

TABLE 6.3

CRITICAL COMMODITY CONTRIBUTION ANALYSIS FOR NOVICHEM (USING TOLERANCES AND 1994/1996 CSFII)

```
Novigen Sciences, Incorporated                                        Ver. 7.06
DEEM Chronic analysis for NOVICHEM                                  (1994-96 data)
Residue file name: H:\DEEM7 training\tolerance7.RS7
                                                  Adjustment factor #2 used.
Analysis Date 02-02-2000/14:07:57     Residue file dated: 02-02-2000/13:33:29/1
Reference dose (RfD, Chronic) = .001 mg/kg bw/day
NOEL (Chronic) = 1 mg/kg bw/day
COMMENT 1: Tolerance-level residues
================================================================================
                 Critical Commodity Contribution Analysis for
                           U.S. Population (total)

                 Total Exposure =.0007545 mg/kg bw/day

            Crop groups with total exposure contribution > 5%
              Foods/Foodforms with exposure contribution > 1%
--------------------------------------------------------------------------------
```

Crop group Food Foodform	Exposure Analysis mg/kg body wt/day	% of Total Exposure	Margin of Exposr 1/	Percent of RfD
Crop Group = (O) Other				
Grapes-juice	0.0000108	1.44%	92,349	1.1%
Total for crop group	0.0000331	4.39%	30,179	3.3%
Crop Group = (M) Meat				
Beef-fat w/o bones	0.0000180	2.38%	55,710	1.8%
Beef-lean (fat/free) w/o bones	0.0000745	9.87%	13,428	7.4%
Pork-fat w/o bone	0.0000102	1.35%	98,017	1.0%
Pork-lean (fat free) w/o bone	0.0000312	4.14%	32,052	3.1%
Total for crop group	0.0001386	18.37%	7,214	13.9%
Crop Group = (D) Dairy Products				
Milk-nonfat solids	0.0000206	2.74%	48,430	2.1%
Milk-fat solids	0.0000157	2.08%	63,627	1.6%
Milk sugar (lactose)	0.0000205	2.71%	48,831	2.0%
Milk-based water	0.0002753	36.49%	3,632	27.5%
Total for crop group	0.0003322	44.02%	3,011	33.2%
Crop Group = (4) Leafy Vegetables (except Brassica)				
Lettuce-head varieties	0.0000230	3.05%	43,437	2.3%
Total for crop group	0.0000299	3.96%	33,486	3.0%
Crop Group = (4A) Leafy Greens				
Lettuce-head varieties	0.0000230	3.05%	43,437	2.3%
Total for crop group	0.0000240	3.18%	41,672	2.4%

TABLE 6.3 (CONT'D)

Crop group / Food / Foodform	Exposure Analysis: mg/kg body wt/day	% of Total Exposure	Margin of Exposr 1/	Percent of RfD
Crop Group = (8) Fruiting Vegetables				
Tomatoes-whole	0.0000092	1.22%	108,574	0.9%
Tomatoes-puree	0.0000146	1.94%	68,462	1.5%
Tomatoes-paste	0.0000138	1.83%	72,409	1.4%
Total for crop group	0.0000420	5.56%	23,832	4.2%
Crop Group = (11) Pome Fruits				
Apples	0.0000155	2.06%	64,389	1.6%
Apples-juice/cider	0.0000266	3.53%	37,568	2.7%
Total for crop group	0.0000470	6.23%	21,260	4.7%
Crop Group = (12) Stone Fruits				
Nectarines	0.0000205	2.72%	48,745	2.1%
Peaches	0.0001036	13.73%	9,650	10.4%
Total for crop group	0.0001317	17.46%	7,593	13.2%
Total for crop groups listed above:	0.0007545	100.00%	1,325	75.4%

1. Margin of Exposure = NOEL / Dietary Exposure

TABLE 6.4

COMPLETE COMMODITY CONTRIBUTION ANALYSIS FOR NOVICHEM (USING TOLERANCES AND 1994/1996 CSFII)

```
Novigen Sciences, Incorporated                                        Ver. 7.06
DEEM Chronic analysis for NOVICHEM                                  (1994-96 data)
Residue file name: H:\DEEM7 training\tolerance7.RS7
                                                  Adjustment factor #2 used.
Analysis Date 02-02-2000/14:07:57     Residue file dated: 02-02-2000/13:33:29/1
Reference dose (RfD, Chronic) = .001 mg/kg bw/day
NOEL (Chronic) = 1 mg/kg bw/day
COMMENT 1: Tolerance-level residues
================================================================================
                 Complete commodity contribution analysis for
                             U.S. Population (total)
--------------------------------------------------------------------------------

Crop Group = (O)  Other
                                                        Exposure Analysis
                                                    ----------------------------
                          Residue    Adjustment        mg/kg  |Margin of| Perc.
       Food name           (ppm)      Factors     body wt/day|Exposr 1/|of RfD
------------------------ ---------- ------------ -----------|---------|------
Grapes                   0.050000   1.000  1.000   0.0000045  221,907    0.5%
Grapes-raisins           0.050000   4.300  1.000   0.0000060  165,716    0.6%
Grapes-juice             0.050000   1.200  1.000   0.0000108   92,349    1.1%
Strawberries             0.020000   1.000  1.000   0.0000012  839,574    0.1%
Grapes-leaves            0.050000   1.000  1.000   0.0000000 >1000000    0.0%
Cottonseed-oil           0.050000   1.000  1.000   0.0000015  650,830    0.2%
Cottonseed-meal          0.050000   1.000  1.000   0.0000000 >1000000    0.0%
Grapes-wine and sherry   0.050000   1.000  1.000   0.0000064  156,987    0.6%
Grapes-juice-concentrate 0.050000   3.600  1.000   0.0000026  387,525    0.3%
Strawberries-juice       0.020000   1.000  1.000   0.0000001 >1000000    0.0%
                                                  ----------- -------- -------
       Crop group subtotal                          0.0000331   30,179    3.3%

Crop Group = (M)  Meat
                                                        Exposure Analysis
                                                    ----------------------------
                          Residue    Adjustment        mg/kg  |Margin of| Perc.
       Food name           (ppm)      Factors     body wt/day|Exposr 1/|of RfD
------------------------ ---------- ------------ -----------|---------|------
Beef-meat byproducts     0.200000   1.000  1.000   0.0000012  832,362    0.1%
Beef-other organ meats   0.100000   1.000  1.000   0.0000003 >1000000    0.0%
Beef-dried               0.100000   1.920  1.000   no exposure
Beef-fat w/o bones       0.100000   1.000  1.000   0.0000180   55,710    1.8%
Beef-kidney              0.100000   1.000  1.000   0.0000000 >1000000    0.0%
Beef-liver               0.200000   1.000  1.000   0.0000011  928,505    0.1%
Beef-lean (fat/free) w/o 0.100000   1.000  1.000   0.0000745   13,428    7.4%
Goat-meat byproducts     0.200000   1.000  1.000   no exposure
Goat-other organ meats   0.100000   1.000  1.000   no exposure
Goat-fat w/o bone        0.100000   1.000  1.000   0.0000000 >1000000    0.0%
Goat-kidney              0.100000   1.000  1.000   no exposure
Goat-liver               0.200000   1.000  1.000   no exposure
Goat-lean (fat/free) w/o 0.100000   1.000  1.000   0.0000002 >1000000    0.0%
Horsemeat                0.200000   1.000  1.000   no exposure
Sheep-meat byproducts    0.200000   1.000  1.000   no exposure
```

TABLE 6.4 (CONT'D)

Crop Group = (M) Meat (continued)

Food name	Residue (ppm)	Adjustment Factors		Exposure Analysis mg/kg body wt/day	Margin of Exposr 1/	Perc. of RfD
Sheep-other organ meats	0.100000	1.000	1.000	no exposure		
Sheep-fat w/o bone	0.100000	1.000	1.000	0.0000001	>1000000	0.0%
Sheep-kidney	0.100000	1.000	1.000	no exposure		
Sheep-liver	0.200000	1.000	1.000	no exposure		
Sheep-lean (fat free) w/o	0.100000	1.000	1.000	0.0000005	>1000000	0.1%
Pork-meat byproducts	0.200000	1.000	1.000	0.0000005	>1000000	0.1%
Pork-other organ meats	0.100000	1.000	1.000	0.0000001	>1000000	0.0%
Pork-fat w/o bone	0.100000	1.000	1.000	0.0000102	98,017	1.0%
Pork-kidney	0.100000	1.000	1.000	no exposure		
Pork-liver	0.200000	1.000	1.000	0.0000002	>1000000	0.0%
Pork-lean (fat free) w/o	0.100000	1.000	1.000	0.0000312	32,052	3.1%
Veal-fat w/o bones	0.100000	1.000	1.000	0.0000000	>1000000	0.0%
Veal-lean (fat free) w/o	0.100000	1.000	1.000	0.0000005	>1000000	0.0%
Veal-kidney	0.100000	1.000	1.000	0.0000000	>1000000	0.0%
Veal-liver	0.200000	1.000	1.000	0.0000000	>1000000	0.0%
Veal-other organ meats	0.100000	1.000	1.000	no exposure		
Veal-dried	0.100000	1.920	1.000	no exposure		
Veal-meat byproducts	0.200000	1.000	1.000	no exposure		
Crop group subtotal				0.0001386	7,214	13.9%

Crop Group = (D) Dairy Products

Food name	Residue (ppm)	Adjustment Factors		Exposure Analysis mg/kg body wt/day	Margin of Exposr 1/	Perc. of RfD
Milk-nonfat solids	0.050000	1.000	1.000	0.0000206	48,430	2.1%
Milk-fat solids	0.050000	1.000	1.000	0.0000157	63,627	1.6%
Milk sugar (lactose)	0.050000	1.000	1.000	0.0000205	48,831	2.0%
Milk-based water	0.050000	1.000	1.000	0.0002753	3,632	27.5%
Crop group subtotal				0.0003322	3,011	33.2%

Crop Group = (4) Leafy Vegetables (except Brassica)

Food name	Residue (ppm)	Adjustment Factors		Exposure Analysis mg/kg body wt/day	Margin of Exposr 1/	Perc. of RfD
Celery	0.100000	1.000	1.000	0.0000058	172,090	0.6%
Lettuce-leafy varieties	0.100000	1.000	1.000	0.0000009	>1000000	0.1%
Lettuce-unspecified	0.100000	1.000	1.000	0.0000000	>1000000	0.0%
Lettuce-head varieties	0.100000	1.000	1.000	0.0000230	43,437	2.3%
Celery juice	0.100000	1.000	1.000	0.0000001	>1000000	0.0%
Crop group subtotal				0.0000299	33,486	3.0%

TABLE 6.4 (CONT'D)

Crop Group = (4A) Leafy Greens

Food name	Residue (ppm)	Adjustment Factors		Exposure Analysis mg/kg body wt/day	Margin of Exposr 1/	Perc. of RfD
Lettuce-leafy varieties	0.100000	1.000	1.000	0.0000009	>1000000	0.1%
Lettuce-unspecified	0.100000	1.000	1.000	0.0000000	>1000000	0.0%
Lettuce-head varieties	0.100000	1.000	1.000	0.0000230	43,437	2.3%
Crop group subtotal				0.0000240	41,672	2.4%

Crop Group = (4B) Leaf Petioles

Food name	Residue (ppm)	Adjustment Factors		Exposure Analysis mg/kg body wt/day	Margin of Exposr 1/	Perc. of RfD
Celery	0.100000	1.000	1.000	0.0000058	172,090	0.6%
Celery juice	0.100000	1.000	1.000	0.0000001	>1000000	0.0%
Crop group subtotal				0.0000059	170,454	0.6%

Crop Group = (8) Fruiting Vegetables

Food name	Residue (ppm)	Adjustment Factors		Exposure Analysis mg/kg body wt/day	Margin of Exposr 1/	Perc. of RfD
Tomatoes-whole	0.020000	1.000	1.000	0.0000092	108,574	0.9%
Tomatoes-juice	0.020000	1.500	1.000	0.0000012	864,970	0.1%
Tomatoes-puree	0.020000	3.300	1.000	0.0000146	68,462	1.5%
Tomatoes-paste	0.020000	5.400	1.000	0.0000138	72,409	1.4%
Tomatoes-catsup	0.020000	2.500	1.000	0.0000032	315,851	0.3%
Tomatoes-dried	0.020000	14.300	1.000	0.0000000	>1000000	0.0%
Crop group subtotal				0.0000420	23,832	4.2%

Crop Group = (11) Pome Fruits

Food name	Residue (ppm)	Adjustment Factors		Exposure Analysis mg/kg body wt/day	Margin of Exposr 1/	Perc. of RfD
Apples	0.035000	1.000	1.000	0.0000155	64,389	1.6%
Apples-dried	0.035000	8.000	1.000	0.0000008	>1000000	0.1%
Apples-juice/cider	0.035000	1.300	1.000	0.0000266	37,568	2.7%
Apples-juice-concentrate	0.035000	3.900	1.000	0.0000041	246,576	0.4%
Crop group subtotal				0.0000470	21,260	4.7%

TABLE 6.4 (CONT'D)

Crop Group = (12) Stone Fruits

Food name	Residue (ppm)	Adjustment Factors		Exposure Analysis: mg/kg body wt/day	Exposure Analysis: Margin of Exposr 1/	Exposure Analysis: Perc. of RfD
Nectarines	1.000000	1.000	1.000	0.0000205	48,745	2.1%
Peaches	1.000000	1.000	1.000	0.0001036	9,650	10.4%
Peaches-dried	1.000000	7.000	1.000	0.0000020	499,501	0.2%
Peaches-juice	1.000000	1.000	1.000	0.0000056	179,921	0.6%
Crop group subtotal				0.0001317	7,593	13.2%
Population subgroup total				0.0007545	1,325	75.4%

1. Margin of Exposure = NOEL / Dietary Exposure

CHAPTER 7. ACUTE EXPOSURE ANALYSIS

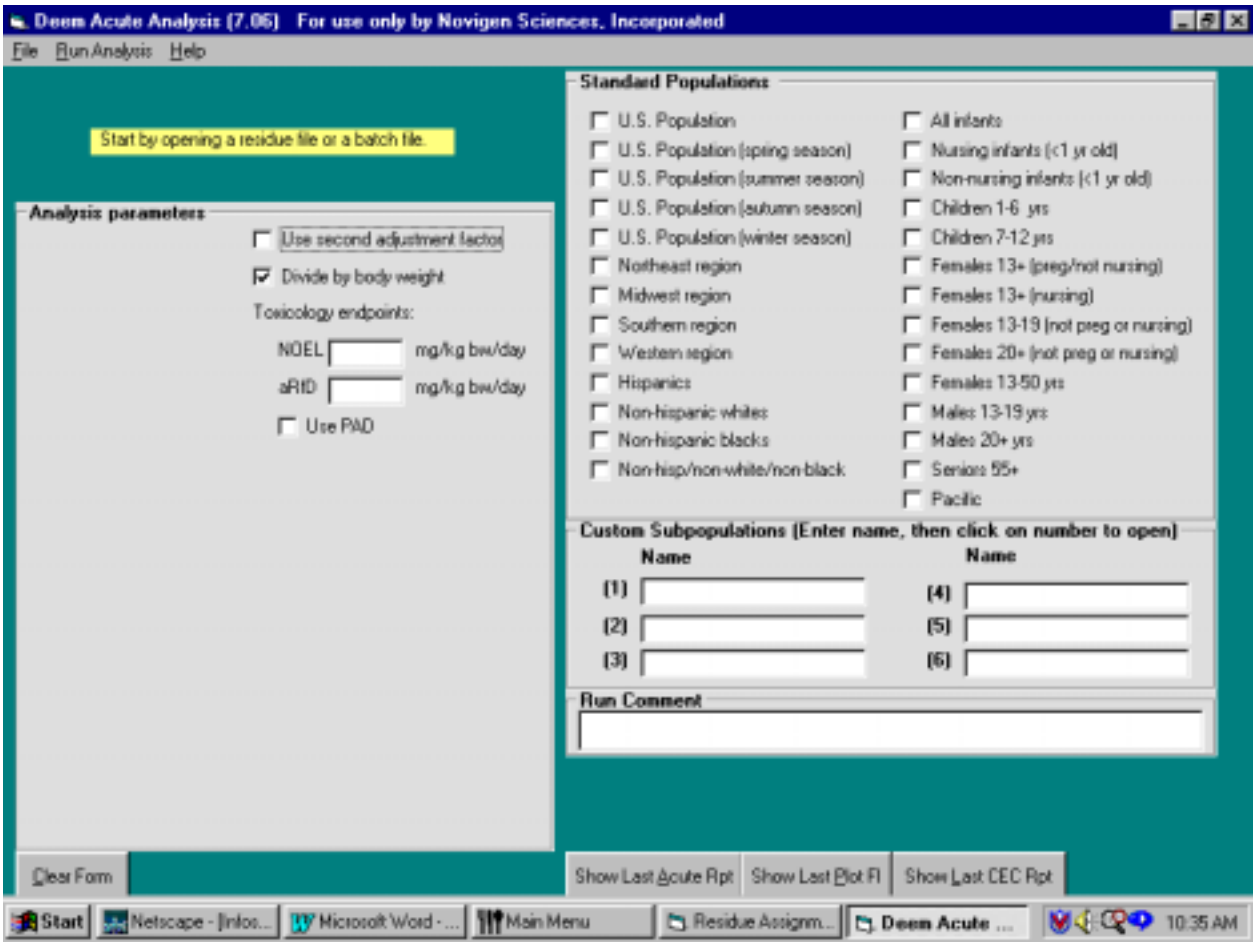
The Acute exposure analysis option of DEEM™ can be used to estimate short-term (e.g., daily) total exposure for the US population and for subgroups of the US population. For example, the Acute exposure analysis option can be used to evaluate potential exposure for various age, sex, reproductive status and ethnic subgroups. It also may be used to estimate exposure at different seasons of the year and in different regions of the country. Although the program contains 27 standard populations, you can define many additional subgroups. (Note that the population subgroups are not identical between the data sets. For example, the 1989/92 CSFII included the geographical region, Western US and was further divided into the regions, Mountain and Pacific. In the 1994/96 CSFII, no further breakdown of the Western region was provided by USDA.)

Please note that if the advanced CEC functions have not been licensed, several of the CEC capaibilities will be unavailable, including: The commodity-level summary at the top of the CEC report; the ability to specify an upper bound other than 100%; the ability to perform "Redo Last CEC".

Like the DEEM™ Chronic analysis, the Acute analysis option requires two data sets (1) individual food consumption files and (2) residue analysis files. The food consumption files are included with the DEEM™ programs and were installed along with the program files. You cannot modify the food consumption files. You must create a residue analysis file for each chemical for which you wish to conduct an exposure assessment.

After you have created and saved your residue analysis file, you can immediately conduct an acute exposure analysis by returning to the main menu and clicking on "Analysis" then "Run Acute." You will be prompted to enter your password.

Once the password has been entered correctly, Screen 7.1 will be displayed.

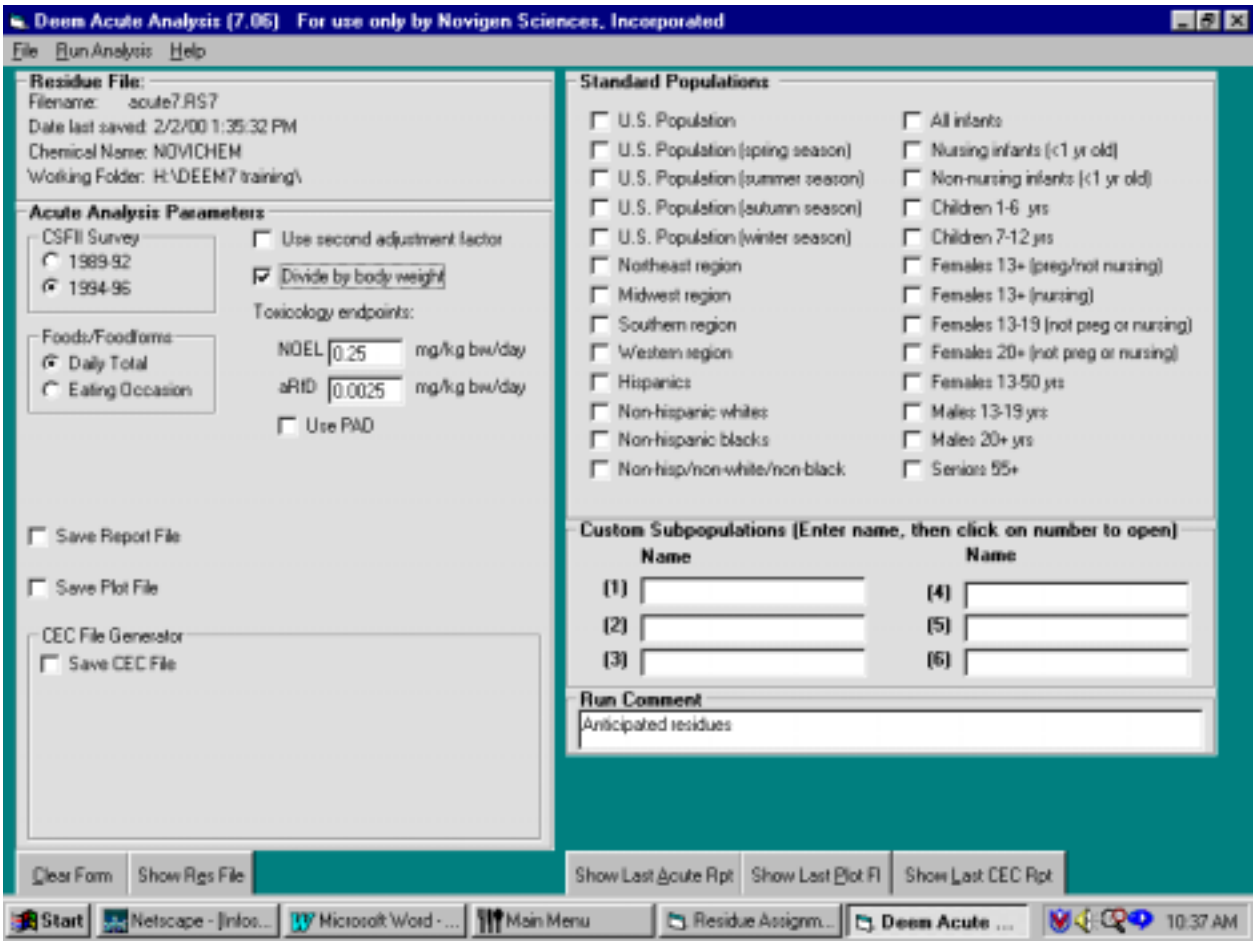


Screen 7.1: Acute analysis entry screen.

The program will save the files to the default directory specified during the initial setup unless you change the directory. To open a file, click on "File" then "Open." You may select a file from a directory by highlighting the specific directory, then selecting the residue file of interest. If you select a file from a directory other than the default directory, the directory must be valid.

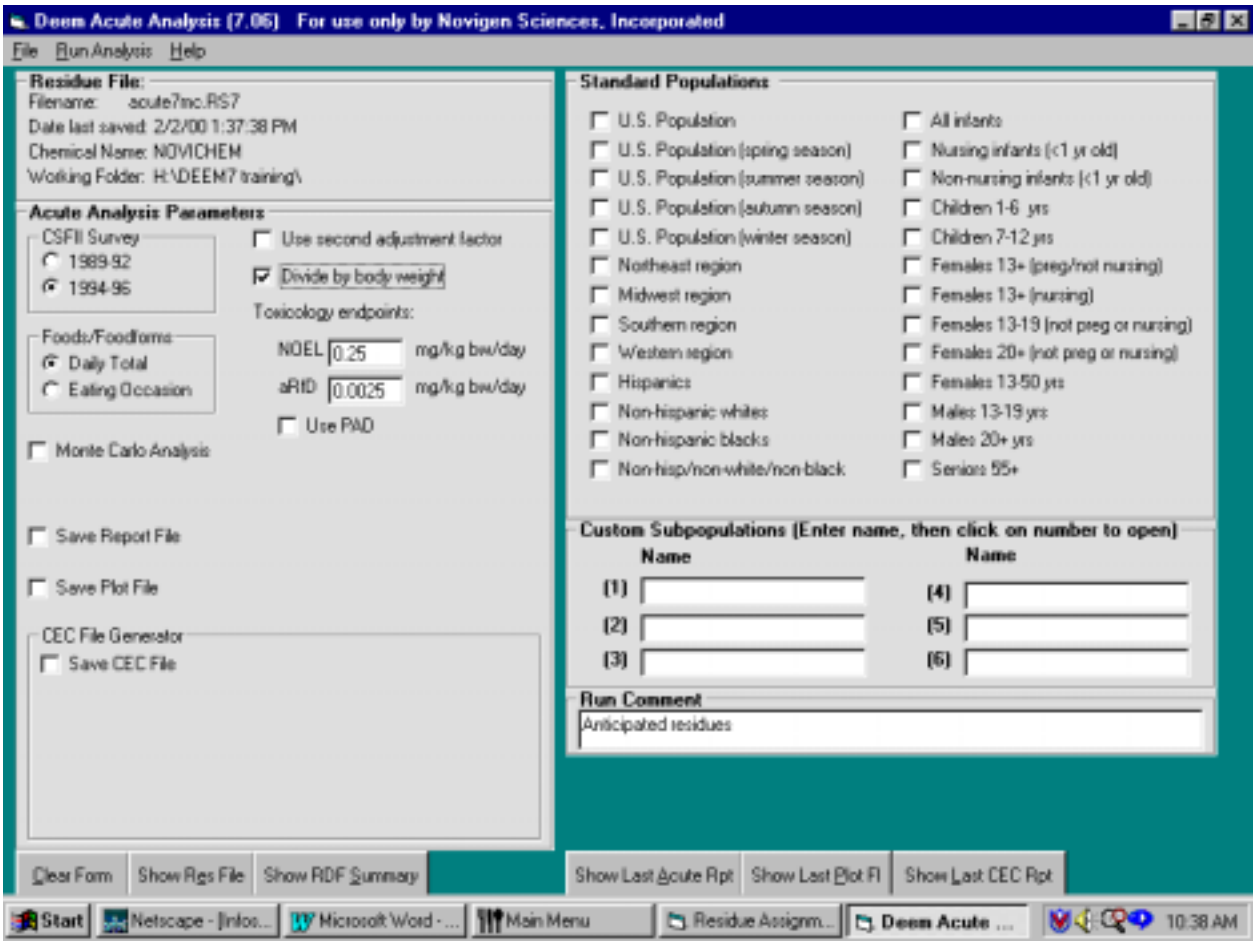
To select a residue file, double click on the file of interest or single click, then press <enter>.

Information about the selected file appears under the heading Residue File in the upper left section of the window Screen 7.2. To select a different file, click on "File" then "Close." To open a new file, click on "Open."



Screen 7.2: Acute Analysis Input Screen (after residue file is selected)

Note that once the residue file has been selected, you then will be given a choice of conducting the analysis using the 1989/92 or 1994/96 CSFII data. If RDF files have been included in the residue file, the acute menu will provide the user with the option of conducting a Monte Carlo analysis (Screen 7.3).



Screen 7.3: Acute Analysis Input Screen (residue file for Monte Carlo analysis selected)

When electing to divide the exposure estimate by respondents' body weights, the program will display the aRfD and NOEL provided in the original residue file. The user has the opportunity to change these values for this analysis only. If you wish to permanently change the aRfD or NOEL in your analysis file you must return to the Add/Edit Header option (Residue File Editor) and make the change in the "Header" information.

To compare exposure to an acute Population Adjusted Dose (aPAD), select the Use PAD option. A window will be displayed with a list of population subgroups. You then must enter the aPAD value for the population group of interest. Note that if the aPAD applies to populations subgroups not listed, the aPAD value may be entered under the custom population subgroup option discussed below.

The user also has the option of including the second adjustment factor (Chapter 5) in the current analysis. Note that the program always multiplies the residue value by Adjustment factor #1. Including an additional adjustment is to be determined by the analyst.

You have the choice to estimate exposure on a daily- or eating-occasion-basis. In the "daily total" assessments, the consumption values correspond to the total daily consumption of the food or food form. In the "eating occasion" assessment the consumption values correspond to the consumption levels at each eating occasion as reported in the consumption surveys. The total daily exposure estimate for each individual is obtained by summing the calculated exposure for each food or food form reported consumed during that day and dividing by the persons body weight. Note that this option is intended for use with the Monte Carlo acute analyses. During each iteration in a Monte Carlo analysis, a random residue value is assigned to the amount of food consumed, resulting in an exposure estimate.

Total daily amount will receive a single residue value at each iteration. In contrast, eating occasion amounts will receive a different residue value each time the food is reported consumed, then the exposure estimates are summed for the particular food of interest. For example, Person 1 reported eating four apples in Day 1 of the survey; however, half an apple was consumed in the morning, 1 ½ apples in the afternoon and 2 apples at bedtime. The total amount consumed is 400 grams.

The residue distribution for apples is 0.5 ppm to 4 ppm. During one iteration of the Monte Carlo analysis for the daily total, it is possible that the maximum residue will be selected and assigned to the total 400 grams consumed, resulting in an exposure estimate of 1.6 mg ai/person. By selecting eating occasions, the maximum residue may be assigned to the half apple amount, resulting in an exposure estimate of 0.2 mg ai/person.

If a Monte Carlo Analysis is selected, you will be prompted to enter the number of iterations for the analysis and the random number seed.

You may also save the analysis to disk by clicking Save Report Files. You will be prompted to enter a file name.

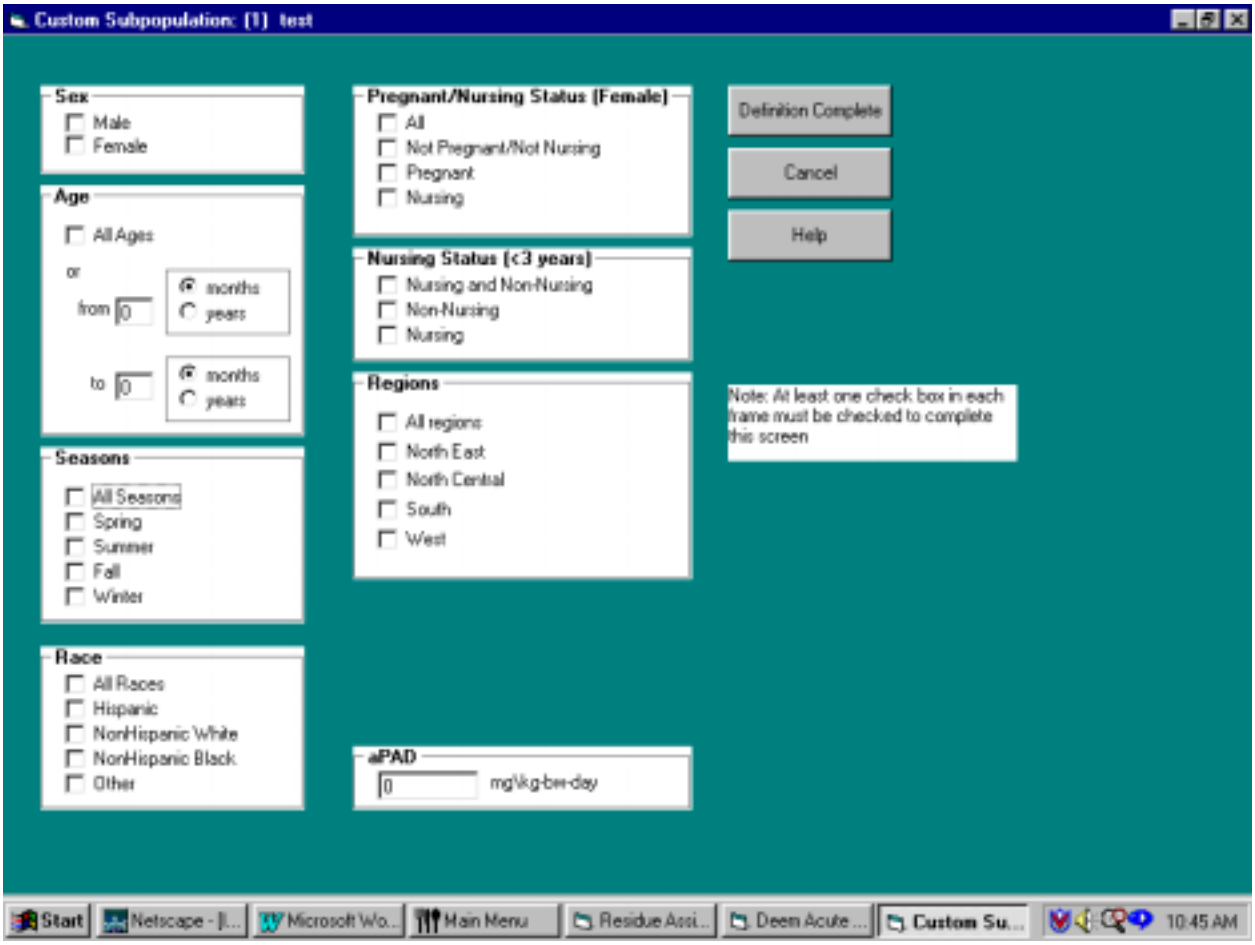
DEEM™ also produces a "plot" file consisting of the entire per-user exposure distribution. The plot file also includes information about the actual (unweighted) and weighted number of people-days and user-days in the populations considered. The plot file is comma delimited and can be imported in a spreadsheet program for statistical manipulation or to produce graphs.

Another option in the Acute analysis window is the Critical Exposure Commodity (CEC) analysis. This will be discussed in detail later in this chapter. The CEC is analogous to the critical commodity contribution for the chronic analysis. This feature permits the user to identify those commodities that are contributing a user-specified percentage to exposure intervals between the 95^{th} percentile of exposure and the maximum exposure estimate.

The "Run Comment" box displays the original comment entered in the header information in the Residue File Editor. The user may enter additional comments that will remain with the documentation for the current analysis only.

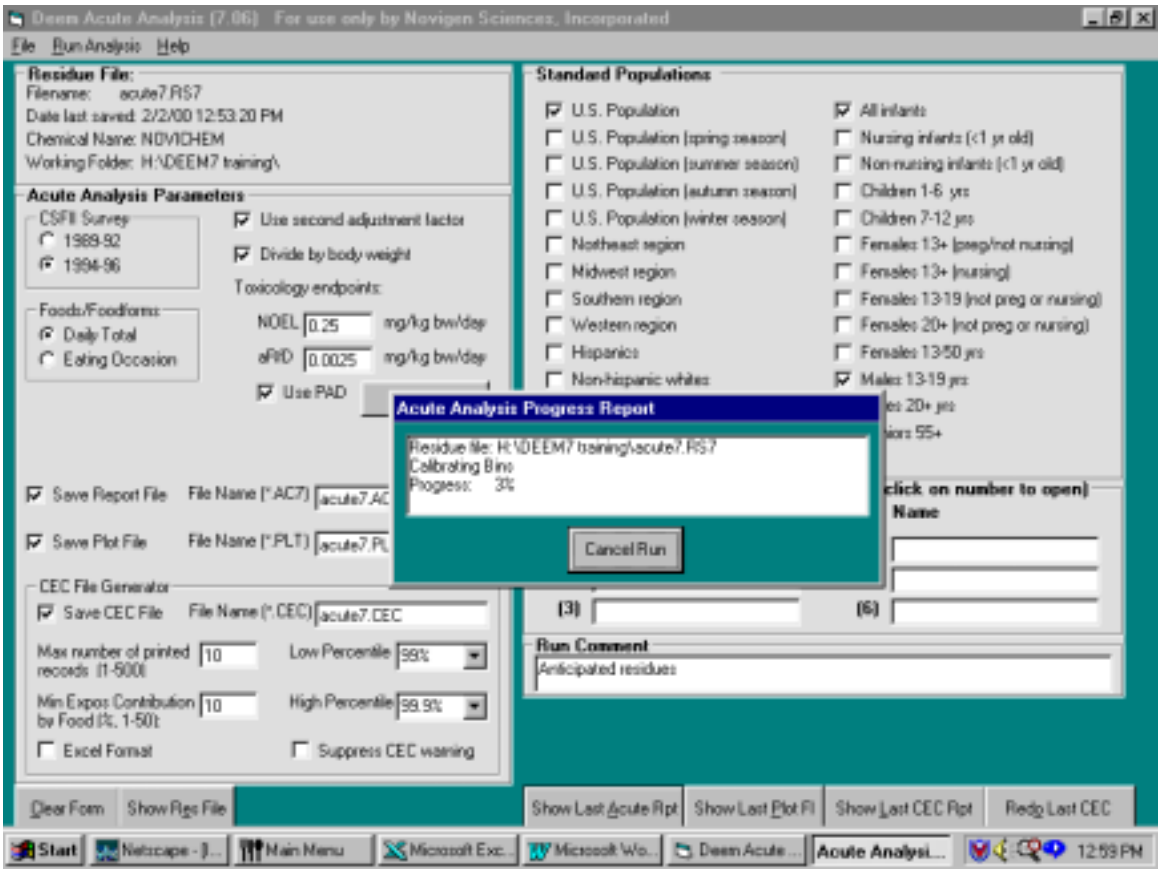
The screen also provides the user with the option to view the current residue file and RDF summary (if RDF files are identified in the residue file). The user also is given the choice of saving the residue file and RDF summary to disk or sending them to the printer.

Prior to conducting the acute analysis, you must select the populations to be analyzed. You may select as many of the standard subgroups as you wish from the menu shown in Screen 7.1 and up to six **CUSTOM POPULATIONS** for any single analysis, Screen 7.4 presents the demographic parameters available for defining the population subgroups of interest. Once the population group has been defined, click on the Definition Complete button and you will be returned to the DEEM™ Acute Analysis screen.



Screen 7.4: Custom Population Groups

Once you've identified the parameters for conducting the analyses and the population groups of interest, click on "Run Analysis" at the top of the Acute Analysis screen (Screen 7.2). A progress window will appear displaying the status of the analysis (Screen 7.5).



Screen 7.5 Acute analysis progress report

Once the analysis is completed, you will have the option to view the results on the screen and to save it to disk or to print the results by clicking the "Show Last Acute Rpt" button.

The results of the acute analysis will include the following information for each subgroup:

- the percent of the population who consumed at least one food included in the residue file (percent consumers)
- mean per-capita consumption (expressed as mg chemical/kg bw/day)
- mean consumption per consumer (expressed as mg chemical/kg bw/day)
- margins of exposure (MOE) for each estimate of exposure (determined by dividing the NOEL by the estimated exposure) or percent aRfD or aPAD
- Percentiles of exposure expressed on a per-capita and a per-consumer basis. The MOE (or percent aRfD/aPAD) also is calculated for each percentile.
- A summary table of the exposure estimates at the upper percentiles of exposure for all population groups analyzed is provided at the beginning of the acute report.

A sample analyses has been conducted using the residue file created in Chapter 5 (ACUTE7.RS7). Table 7.1 displays the results of an Acute dietary exposure analysis for the US population and for; this analysis is equivalent to an EPA Tier 2 acute analysis.

TABLE 7.1

TIER 2 ACUTE ANALYSIS FOR NOVICHEM

```
Novigen Sciences, Incorporated                                        Ver. 7.06
DEEM ACUTE analysis for NOVICHEM                                   (1994-96 data)
Residue file: acute7.RS7                                 Adjustment factor #2 used.
Analysis Date: 02-02-2000/14:17:32    Residue file dated: 02-02-2000/13:35:32/1
NOEL (Acute) =   0.250000 mg/kg body-wt/day
Acute Pop Adjusted Dose (aPAD) varies with population; see individual reports
Daily totals for food and foodform consumption used.
Run Comment: "Anticipated residues"
================================================================================

Summary calculations (per capita):

      95th Percentile             99th Percentile             99.9th Percentile
 Exposure  % aPAD     MOE    Exposure  % aPAD     MOE    Exposure  % aPAD     MOE
---------- ------- -------- ---------- ------- -------- ---------- ------- --------
U.S. Population:
  0.000915   36.60     273    0.002209   88.36     113    0.006680  267.21      37
All infants:
  0.004233  529.16      59    0.008168 1021.03      30    0.013630 1703.78      18
```

TABLE 7.1 (CONT'D)

Novigen Sciences, Incorporated Ver. 7.06
DEEM ACUTE analysis for NOVICHEM (1994-96 data)
Residue file: acute7.RS7 Adjustment factor #2 used.
Analysis Date: 02-02-2000/14:17:32 Residue file dated: 02-02-2000/13:35:32/1
NOEL (Acute) = 0.250000 mg/kg body-wt/day
Acute Reference Dose (aRfD) = 0.002500 mg/kg body-wt/day
Daily totals for food and foodform consumption used.
Run Comment: "Anticipated residues"

U.S. Population — Daily Exposure Analysis 1/ (mg/kg body-weight/day)

	per Capita	per User
Mean	0.000294	0.000296
Standard Deviation	0.000534	0.000535
Standard Error of mean	0.000003	0.000003
Margin of Exposure 2/	849	844
Percent of aRfD	11.77	11.84

Percent of Person-Days that are User-Days = 99.40%

Estimated percentile of user-days falling below calculated exposure in mg/kg body-wt/day with Margin of Exposure (MOE) and Percent of aPAD

Perc.	Exposure	% aRfD	MOE	Perc.	Exposure	% aRfD	MOE
10.00	0.000031	1.26	7,952	90.00	0.000584	23.34	428
20.00	0.000065	2.59	3,860	95.00	0.000919	36.75	272
30.00	0.000099	3.97	2,515	97.50	0.001370	54.80	182
40.00	0.000137	5.46	1,830	99.00	0.002214	88.55	112
50.00	0.000177	7.08	1,413	99.50	0.003297	131.90	75
60.00	0.000223	8.93	1,119	99.75	0.004852	194.10	51
70.00	0.000286	11.43	874	99.90	0.006683	267.31	37
80.00	0.000379	15.17	659				

Estimated percentile of per-capita days falling below calculated exposure in mg/kg body-wt/day with Margin of Exposure (MOE) and Percent of aPAD

Perc.	Exposure	% aRfD	MOE	Perc.	Exposure	% aRfD	MOE
10.00	0.000030	1.19	8,412	90.00	0.000581	23.25	430
20.00	0.000063	2.52	3,970	95.00	0.000915	36.60	273
30.00	0.000098	3.91	2,554	97.50	0.001365	54.61	183
40.00	0.000135	5.41	1,847	99.00	0.002209	88.36	113
50.00	0.000176	7.03	1,422	99.50	0.003293	131.71	75
60.00	0.000222	8.89	1,125	99.75	0.004836	193.44	51
70.00	0.000285	11.38	878	99.90	0.006680	267.21	37
80.00	0.000378	15.11	661				

1/ Analysis based on all two-day participant records in CSFII 1994-96 survey.
2/ Margin of Exposure = NOEL/ Dietary Exposure.

TABLE 7.1 (CONT'D)

```
Novigen Sciences, Incorporated                                        Ver. 7.06
DEEM ACUTE analysis for NOVICHEM                                   (1994-96 data)
Residue file: acute7.RS7                              Adjustment factor #2 used.
Analysis Date: 02-02-2000/14:17:32    Residue file dated: 02-02-2000/13:35:32/1
NOEL (Acute) =   0.250000 mg/kg body-wt/day
Acute Pop Adjusted Dose (aPAD) =   0.000800 mg/kg body-wt/day
Daily totals for food and foodform consumption used.
Run Comment: "Anticipated residues"
================================================================================
```

All infants

Daily Exposure Analysis (mg/kg body-weight/day)	per Capita	per User
Mean	0.000614	0.000801
Standard Deviation	0.001701	0.001904
Standard Error of mean	0.000063	0.000083
Margin of Exposure	407	312
Percent of aPAD	76.73	100.06

Percent of Person-Days that are User-Days = 76.68%

Estimated percentile of user-days falling below calculated exposure in mg/kg body-wt/day with Margin of Exposure (MOE) and Percent of aPAD

Perc.	Exposure	% aPAD	MOE	Perc.	Exposure	% aPAD	MOE
10.00	0.000011	1.41	22,173	90.00	0.003004	375.51	83
20.00	0.000029	3.59	8,705	95.00	0.005233	654.15	47
30.00	0.000053	6.58	4,752	97.50	0.007353	919.08	34
40.00	0.000068	8.48	3,683	99.00	0.008514	1064.25	29
50.00	0.000084	10.49	2,978	99.50	0.011319	1414.87	22
60.00	0.000120	15.02	2,080	99.75	0.013550	1693.80	18
70.00	0.000251	31.39	995	99.90	0.015530	1941.24	16
80.00	0.000528	65.94	473				

Estimated percentile of per-capita days falling below calculated exposure in mg/kg body-wt/day with Margin of Exposure (MOE) and Percent of aPAD

Perc.	Exposure	% aPAD	MOE	Perc.	Exposure	% aPAD	MOE
10.00	0.000000	0.00	>1,000,000	90.00	0.001629	203.61	153
20.00	0.000000	0.00	>1,000,000	95.00	0.004233	529.16	59
30.00	0.000010	1.24	25,142	97.50	0.006686	835.77	37
40.00	0.000034	4.25	7,357	99.00	0.008168	1021.03	30
50.00	0.000061	7.60	4,113	99.50	0.010368	1296.05	24
60.00	0.000080	9.94	3,144	99.75	0.011400	1425.03	21
70.00	0.000128	15.95	1,959	99.90	0.013630	1703.78	18
80.00	0.000327	40.92	763				

Results of the acute analysis can be used to describe the distribution of exposure among the US population (either on a per-capita or per-consumer basis) or a selected subgroup of the population. The results are expressed as the proportion of individuals in the population who have an exposure less than or equal to the specified amount, e.g. in Table 7.1, 90% of the US population has an exposure equal to or less than 0.000581 mg/kg bw/day (on a per-capita basis).

MONTE CARLO ANALYSES

The DEEM ™ acute module also has the capability of using the entire consumption distribution in conjunction with residue distributions in a Monte Carlo simulation.

Results of the Monte Carlo analyses are displayed in the same format as a DEEM™ ACUTE MODULE analysis – the only difference being an indication that a Monte Carlo analysis was conducted and the number of iterations listed in the report header.

In the Monte Carlo analysis, the exposure estimates are derived using the following procedure:

1. Consumption of food 1 by individual 1 on day 1 is multiplied by a randomly selected residue value from the residue distribution for food 1.

2. Step 1 is repeated for all foods in the assessment consumed by individual 1 on day 1.

3. The exposure estimates for all foods consumed by individual 1 on day 1 are summed to determine the total dietary exposure for individual 1.

4. Steps 1 to 3 are repeated N times, still using the consumption data for individual 1 on day 1.

5. The N exposure estimates for person 1 on day 1 are stored as frequencies in exposure intervals.

6. Steps 1 to 5 are repeated for individual 1 on the remaining survey day(s).

7. Steps 1 to 6 are repeated for all individuals in the population of concern.

8. The frequency distribution of the exposure estimates for all individuals on all survey days is used to derive the percentile estimates.

N = an iteration.

Performing Monte Carlo (MC) analyses requires two kinds of files:

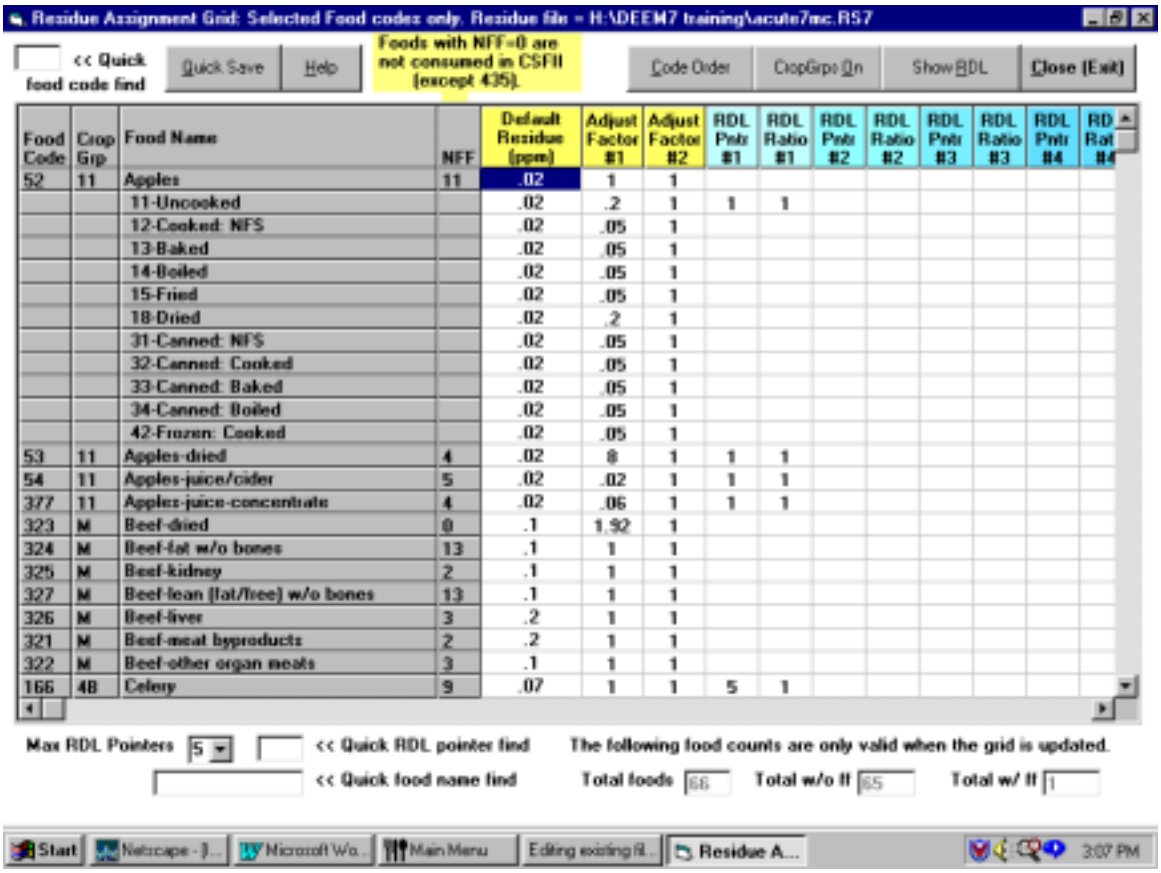
(1) A residue file (R96 or RS7) similar to that used in the conventional (i.e., point estimate) DEEM ™ acute analyses.

- The residue value for the food/FF combination in the R96/RS7 file will be included in the MC exposure analysis unless a residue distribution is assigned to that food/FF, in which case the latter will take precedence and the R96/RS7 value is ignored.

(2) Residue distribution files

- Residue distributions for specific foods/foodforms can be drawn from (1) RDF file (no change in format from pre-DEEM 7.0 versions[1]) or (2) parametric distribution functions. Up to five parametric distribution functions (and/or RDF files), each having an associated probability of use, can be specified for a given food/foodform. (The probabilities of use for any given set of functions must add up to 1.0.) Screen 7.6 shows the residue input grid from the Residue File Editor with five RDL pointers and associated probabilities (ratio) columns displayed.

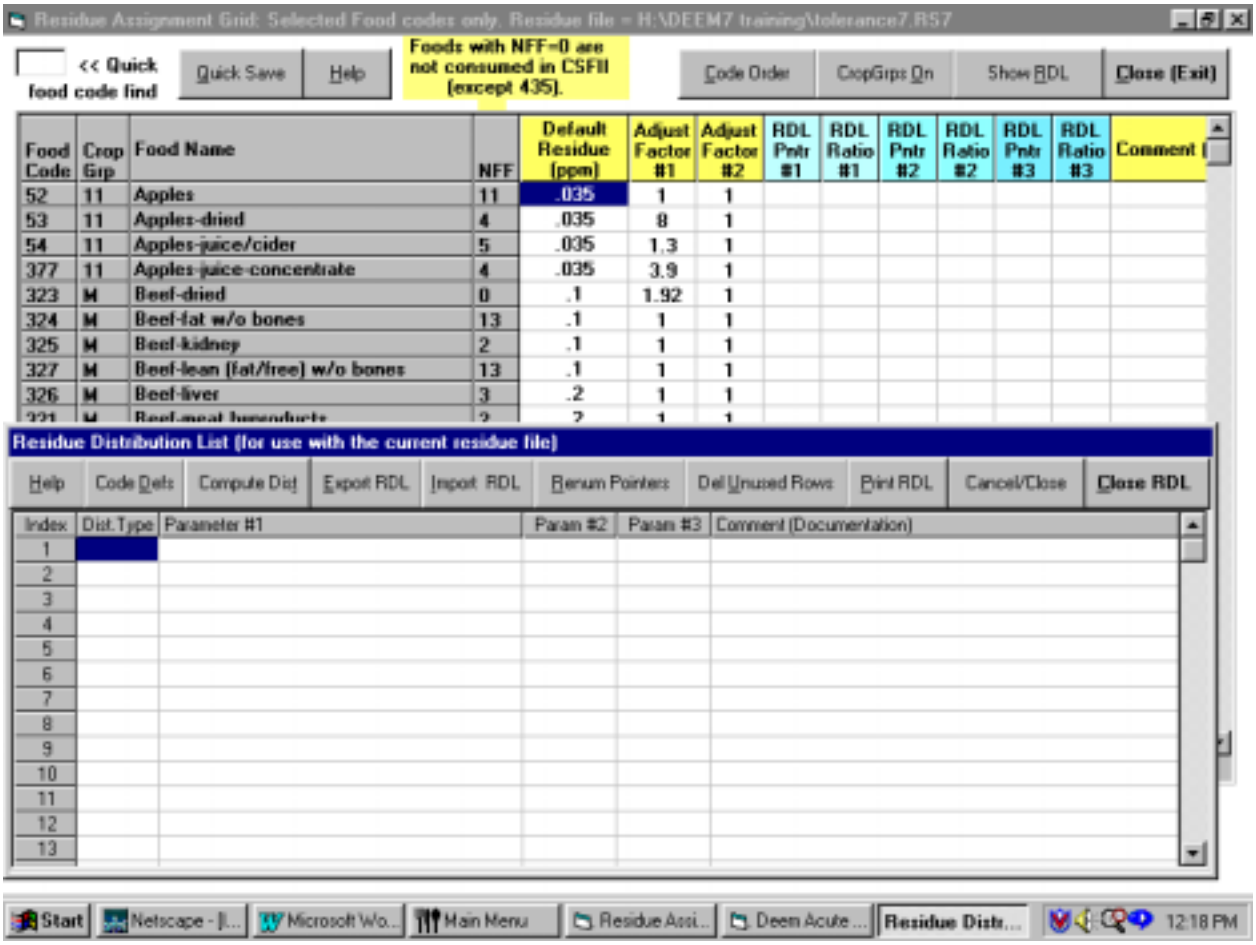
[1] RDFs may have TOTALLOD and LODRES keywords on the same line; however, there must be at least one blank space between the numbers used with TOTALLOD and LODRES (e.g., TOTALLOD = 10 LODRES = 0.1). Also, RDFs now support having residues associated with only TOTALZ and TOTALLOD (i.e., no residue distribution in the body of the RDF).



Screeen 7.6: Residue File Editor

Parametric distribution functions and RDFs referenced in a RS7 residue file must be entered into a "residue distribution list" (RDL), indexed from 1-500 (in a manner similar to the list of residue distribution files in previous versions of DEEM™). This list is part of the residue file, along with the assignment of residue data for each food/foodform to be evaluated.

To display the RDL, click on "Show RDL." The RDL window will appear (Screen 7.7).



Screen 7.7: RDL Window

The RDL has 6 columns: (1) pre-assigned index numbers[2]; (2) the parametric distribution function (0-6), (3) parameter #1, (4) parameter #2, (5) parameter #3, and (6) comment or documentation. The parameters are entered as follows:

Distribution type 0 (constant): the constant residue value is parameter #1; other parameters are left blank

Distribution type 1 (uniform): the low bound is parameter #1[3], the high bound is parameter #2, parameter #3 may be left blank or used to specify the upper-bound value in the distribution.

Distribution type 2 (pareto): the location is parameter #1, the shape is parameter #2, parameter #3 may be left blank or used to specify the upper-bound value in the distribution.

Distribution type 3 (triangular): the low bound of the distribution is parameter #1, the most likely value is parameter #2, the high bound is parameter #3.

[2] Although identified as indices in the RDL, these values correspond to the RDL pointer# in the residue assignment grid.
[3] Low end distribution functions can be zero.

Distribution type 4 (normal): the mean is parameter #1, the standard deviation is parameter #2, parameter #3 may be left blank or used to specify the upper-bound value in the distribution.
Distribution type 5 (lognormal): the mean is parameter #1, the standard deviation is parameter #2, parameter #3 may be left blank or used to specify the upper-bound value in the distribution.
Distribution type 6 (RDF file): the name of the RDF file is parameter #1; the other parameters are left blank. The RDF file must be in the same directory as the residue file. (If an R96 file that contains RDFs is edited using DEEM 7.0, the program automatically assigns the code 6 in the residue grid and RDL. A discussion of the format for RDF files is presented in Appendix E.)

Residue distributions in the RDL are assigned to food/foodforms in the residue file using pointers corresponding to their indices in the RDL. For example, if the residue amount for rac 10, ff 11, is to be derived from the residue distribution function located in the second row (index #2) of the RDL, then the pointer "2" is entered in the column labeled "RDL Pntr #1" in the residue data entry grid for that food/foodform.

When the residue data entry grid for a new residue file is first displayed, only one column is shown for entering RDL pointers, and no column for the RDL ratio is shown. (If only one RDL distribution is referenced, it is assumed that the RDL ratio is 1.0). However, for any given food/foodform, up to 5 different parametric distribution functions can be referenced using RDL pointers, along with an RDL ratio for each function, i.e., the probability assigned to each function for this use. Probabilities must be in the range 0 to 1.00, with the sum of all RDL ratios for any given food/foodform adding to 1.00. An RDL ratio can be set to zero; however, the sum of all RDL ratios for any food/foodform must equal 1.00. (The program will confirm this before the residue data entry grid form is closed.)

To add columns for additional RDL pointers and ratios in the residue data entry grid, click on the box labeled "Max(imum number of) RDL pointers" at the bottom left of the residue data entry screen and choose the number of pointers to be displayed. Up to five pointers (with their respective RDL ratios) can be displayed; however, the number displayed cannot be fewer than the maximum number of RDL pointers contained in the current file. (When editing an existing file, the maximum number of RDL pointers in that file determines how many columns will be shown when the grid is first displayed.)

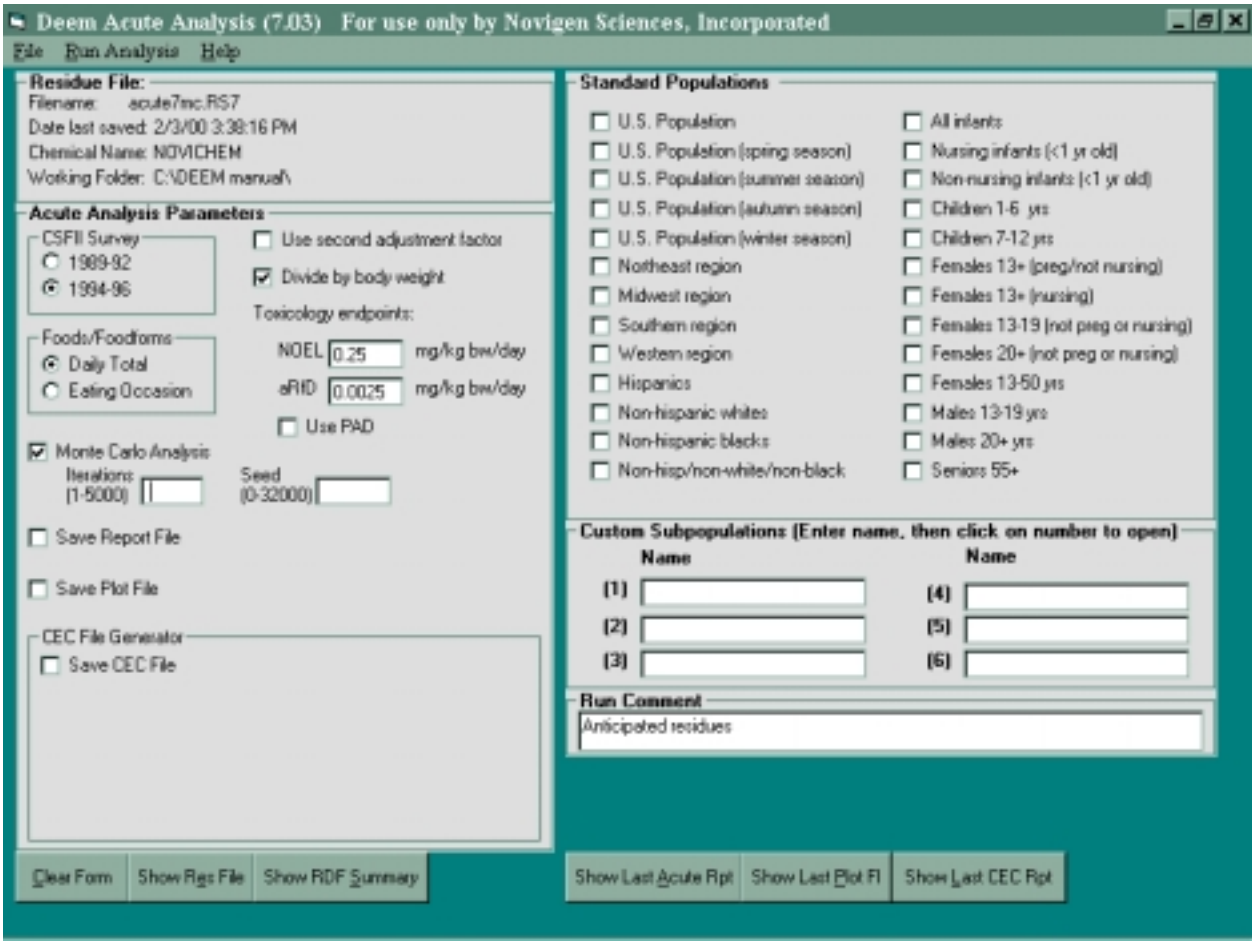
The RDL form also contains several additional command buttons:

(1) "Help": Displays general information about the RDL, or information specific to command buttons and column headings in this form. A small menu is displayed when the "Help" button is selected. First, click on the topic of interest (all pertaining to the RDL form) and then click on the "Show" button. To cancel help at this time, click on the x in the upper corner of the menu box. No object outside this menu box can be accessed until "Show" or cancel has been selected.
(2) "Code Defs": Displays a list of the distribution codes, definitions, and associated parameters, similar to the list shown above.
(3) "Compute Dist(ribution)": Displays a matrix of the full range of computed residue values attributable to the parametric distribution function (or RDF file) referenced at the currently highlighted line in the RDL file. The range of residues is expressed as a function of random sampling values at steps of 0.01 to 0.99 and at 0.9999999 (the random sampling value is constrained to values less than 1.0.)
(4) "Import RDL": Allows you to import a specially formatted RDL file that has been previously saved to disk as an ASCII file (independent of a residue file). This file will replace any information in the current file. (Verification of overwrite is requested.)
(5) "Export RDL": Saves the currently displayed RDL to the disk as an ASCII file. This file can then be imported into another residue file.
(6) "Renum(ber) Pointers": Allows the user to change all instances of a given pointer in the current residue file (not in the RDL itself) from one pointer value to another. Clicking on this button opens "From" and "To" text boxes. Fill in these boxes with the old and new pointer designators, then click on the Renum Pointers button a second time to active these changes. Confirmation of the changes is reported.
(7) "Delete Unused Rows": If distribution functions have been deleted from the RDL, there will be empty rows. To close up the list (i.e., delete empty rows) click on the "Delete Unused Row" button. Residue functions below the empty rows will be associated with a new index number. The pointers in the current residue file will be updated automatically to correspond to the new index numbers.
(8) "Print RDL": Sends a copy of the current RDL to the printer. This feature permits a visual reference of the pointers to facilitate data entry. (The RDL will not remain open on the screen while pointers for specific foods/foodforms are entered into the residue grid.)
(9) "Cancel/Close": Closes the RDL form without checking or saving any changes made while the RDL was currently displayed. Confirmation requested. (This method is not recommended to exit this form.)
(10) "Close": This closes and checks the data in the RDL and returns you to the residue data entry grid. (This is the recommended way to exit the RDL form.)

When computing a distribution for a large RDF, DEEM will alert the user that the RDF file is large (e.g., over 100,000 residue values). This warning simply says that the file is large and will take some time to set up.

Another feature on the residue data entry screen is the "Quick RDL Pointer Find" text box. To locate a specific RDL pointer in the current residue file without visually scanning the entire file, enter the pointer number and press "Enter" or double click the mouse. The next food/foodform combination with the target RDL pointer will be located and highlighted.

To conduct a Monte Carlo analysis using DEEM™ software, follow the same procedure for conducting a standard acute analysis as discussed earlier in this chapter. If the selected residue file contains RDF files, a box labeled "Monte Carlo" automatically will be displayed. Click on the box; two additional boxes will be displayed prompting the user to enter the number of iterations and the random seed number (Screen 7.8).



Screen 7.8: Monte Carlo data entry screen

You will be prompted to enter the number of iterations to be used in the current analysis. The number of iterations will depend on the number of residue data points in the residue distribution files. Typically, the more data points, the more iterations are needed to ensure that the entire residue distribution is sampled.

You also will be prompted to specify a random number seed. This number is used by the program to begin the random selection of residue values. Selecting the same seed number (except 0), the same number of iterations, and the same residue files should produce the same results each time the analysis is conducted; however, you must reinitialize the random seed. If a zero is selected as the seed, the randomization is performed using the time on the computer's clock to initiate the randomization.

Once you have identified the *.R96/RS7 file to be used in the analysis, the procedures are the same as those discussed for the standard acute analysis.

For NOVICHEM, we have created several RDF files (an example of an RDF file is presented in Table 7.3). Based on EPA guidelines, we have incorporated percent of the crop treated into the RDF files for those foods identified by the EPA as single-serving foods and for which crop treated information was available (Table 5.6). Mean field trial residue values are used for blended/processed foods. Note that EPA policy on the proper use of residue data in acute analyses is still evolving. (See Chapter 4, *Guidelines for Conducting Exposure Assessments* for further discussion of the EPA tiered approach to acute analyses.)

TABLE 7.3

NOVICHEM RESIDUE DISTRIBUTION FILE (RDF)

APPLES
PERCENT CROP TX = 10%
TOTALNZ = 33
TOTALZ = 297

0.0030	0.0030	0.0030
0.0038	0.0034	0.0020
0.0030	0.0122	0.0030
0.0051	0.0200	0.0020
0.0069	0.0020	0.0020
0.0051	0.0020	0.0030
0.0037	0.0078	0.0020
0.0020	0.0079	0.0030
0.0030	0.0045	0.0047
0.0030	0.0065	0.0043
0.0039	0.0036	0.0020

Note: Residue values can be in any order, but must be in ppm units.

We can use the ACUTE7.RS7 file created in Chapter 5; however, we first must modify it to add the RDF file designations. (To simplify the example here, only RDF files will be used.)

Using the Add/Edit/Food/Foodforms screen in the Residue File Editor, click on the "Show RDL" button. A grid will appear. Enter the index number 6 (designation for RDF), then double-click on the first row of the Parameter #1 column. Because this uses an RDF, the other parameters will remain blank. You may then assign one RDF file to each of the file numbers on the grid. All RDF files must be in the same directory as the related RS7 file.

Next, enter the index number in the "RDL pointer#" column in the residue grid. If, for example, the RDF list contained apple.rdf as Index 1, the number 1 would be entered in the "RDL pointer #" column for apples. If only one distribution is assigned to a food/foodform, the program does not require a value to be entered in the "RDL ratio" column. During the Monte Carlo analysis, the data in the apples.rdf file would be used for all foods and foodforms with a number 1 in the "RDL Pointer#" column. **If no number is entered in the "RDL pointer #" column, the data in the "Residue" field will be used in the acute analysis. You do not have to use a residue distribution for all foods in the residue file.**

Your RS7 file should look like the one in Table 7.4. Table 7.5 shows the results of the Monte Carlo analysis for our hypothetical chemical NOVICHEM (in the interest of time, only 10 iterations were performed). This analysis is equivalent to an EPA Tier 3 analysis.

TABLE 7.4

RESIDUE FILE FOR MONTE CARLO ANALYSIS FOR NOVICHEM

```
Novigen Sciences, Incorporated                                          Ver. 7.03
DEEM Acute analysis for NOVICHEM
Residue file name: C:\DEEM manual\acute7mc.RS7
Analysis Date 02-06-2000            Residue file dated: 02-03-2000/15:38:17/1
Reference dose: aRfD = 0.0025 mg/kg bw/day  NOEL = 0.25 mg/kg bw/day
Comment: Anticipated residues
-------------------------------------------------------------------------------
RDL indices and parameters for Monte Carlo Analysis:
Index Dist Parameter #1           Param #2    Param #3    Comment
  #   Code
----- ---- ------------           ----------- ----------- ----------
  1    6   Apple.rdf
  2    6   Grape.rdf
  3    6   Lettuce.rdf
  4    6   Peach.rdf
  5    6   Celery.rdf
  6    6   Straw.rdf
  7    6   Tomato.rdf
```

Food Code	Crop Grp	Food Name	Def Res (ppm)	Adj.Factors #1	Adj.Factors #2	RDL Ind
13	O	Grapes	0.025000	1.000	1.000	2
14	O	Grapes-raisins	0.025000	1.000	1.000	2
15	O	Grapes-juice	0.025000	0.060	1.000	2
17	O	Strawberries	0.014000	1.000	1.000	6
52	11	Apples				
		11-Uncooked	0.020000	0.200	1.000	1
		12-Cooked: NFS	0.020000	0.050	1.000	1
		13-Baked	0.020000	0.050	1.000	1
		14-Boiled	0.020000	0.050	1.000	1
		15-Fried	0.020000	0.050	1.000	1
		18-Dried	0.020000	0.200	1.000	1
		31-Canned: NFS	0.020000	0.050	1.000	1
		32-Canned: Cooked	0.020000	0.050	1.000	1
		33-Canned: Baked	0.020000	0.050	1.000	1
		34-Canned: Boiled	0.020000	0.050	1.000	1
		42-Frozen: Cooked	0.020000	0.050	1.000	1
53	11	Apples-dried	0.020000	8.000	1.000	1
54	11	Apples-juice/cider	0.020000	0.020	1.000	1
64	12	Nectarines	0.600000	1.000	1.000	4
65	12	Peaches	0.600000	1.000	1.000	4
66	12	Peaches-dried	0.600000	7.000	1.000	4
159	8	Tomatoes-whole	0.011000	1.000	1.000	7
160	8	Tomatoes-juice	0.011000	0.020	1.000	7
161	8	Tomatoes-puree	0.011000	0.020	1.000	7
162	8	Tomatoes-paste	0.011000	0.500	1.000	7
163	8	Tomatoes-catsup	0.011000	0.020	1.000	7
166	4B	Celery	0.070000	1.000	1.000	5
176	4A	Lettuce-leafy varieties	0.100000	1.000	1.000	3
182	4A	Lettuce-unspecified	0.100000	1.000	1.000	3
192	4A	Lettuce-head varieties	0.100000	1.000	1.000	3
195	O	Grapes-leaves	0.025000	1.000	1.000	2
290	O	Cottonseed-oil	0.005000	0.010	1.000	
291	O	Cottonseed-meal	0.005000	0.020	1.000	
315	O	Grapes-wine and sherry	0.025000	1.000	1.000	2
318	D	Milk-nonfat solids	0.005000	1.000	1.000	
319	D	Milk-fat solids	0.005000	1.000	1.000	
320	D	Milk sugar (lactose)	0.005000	1.000	1.000	
321	M	Beef-meat byproducts	0.200000	1.000	1.000	
322	M	Beef-other organ meats	0.100000	1.000	1.000	

TABLE 7.4 (CONT'D)

323	M	Beef-dried	0.100000	1.920	1.000	
324	M	Beef-fat w/o bones	0.100000	1.000	1.000	
325	M	Beef-kidney	0.100000	1.000	1.000	
326	M	Beef-liver	0.200000	1.000	1.000	
327	M	Beef-lean (fat/free) w/o bones	0.100000	1.000	1.000	
328	M	Goat-meat byproducts	0.200000	1.000	1.000	
329	M	Goat-other organ meats	0.100000	1.000	1.000	
330	M	Goat-fat w/o bone	0.100000	1.000	1.000	
331	M	Goat-kidney	0.100000	1.000	1.000	
332	M	Goat-liver	0.200000	1.000	1.000	
333	M	Goat-lean (fat/free) w/o bone	0.100000	1.000	1.000	
334	M	Horsemeat	0.200000	1.000	1.000	
336	M	Sheep-meat byproducts	0.200000	1.000	1.000	
337	M	Sheep-other organ meats	0.100000	1.000	1.000	
338	M	Sheep-fat w/o bone	0.100000	1.000	1.000	
339	M	Sheep-kidney	0.100000	1.000	1.000	
340	M	Sheep-liver	0.200000	1.000	1.000	
341	M	Sheep-lean (fat free) w/o bone	0.100000	1.000	1.000	
342	M	Pork-meat byproducts	0.200000	1.000	1.000	
343	M	Pork-other organ meats	0.100000	1.000	1.000	
344	M	Pork-fat w/o bone	0.100000	1.000	1.000	
345	M	Pork-kidney	0.100000	1.000	1.000	
346	M	Pork-liver	0.200000	1.000	1.000	
347	M	Pork-lean (fat free) w/o bone	0.100000	1.000	1.000	
377	11	Apples-juice-concentrate	0.020000	0.060	1.000	1
384	4B	Celery juice	0.070000	1.000	1.000	5
392	O	Grapes-juice-concentrate	0.025000	0.180	1.000	2
398	D	Milk-based water	0.005000	1.000	1.000	
402	12	Peaches-juice	0.600000	1.000	1.000	4
416	O	Strawberries-juice	0.014000	1.000	1.000	6
423	8	Tomatoes-dried	0.011000	14.300	1.000	7
424	M	Veal-fat w/o bones	0.100000	1.000	1.000	
425	M	Veal-lean (fat free) w/o bones	0.100000	1.000	1.000	
426	M	Veal-kidney	0.100000	1.000	1.000	
427	M	Veal-liver	0.200000	1.000	1.000	
428	M	Veal-other organ meats	0.100000	1.000	1.000	
429	M	Veal-dried	0.100000	1.920	1.000	
430	M	Veal-meat byproducts	0.200000	1.000	1.000	

TABLE 7.5

RESULTS OF THE MONTE CARLO ACUTE ANALYSIS

```
Novigen Sciences, Incorporated                                        Ver. 7.06
DEEM ACUTE analysis for NOVICHEM                                   (1994-96 data)
Residue file: acute7mc.RS7                          Adjustment factor #2 NOT used.
Analysis Date: 02-03-2000/15:43:59    Residue file dated: 02-03-2000/15:38:17/1
NOEL (Acute) =   0.250000 mg/kg body-wt/day
Acute Pop Adjusted Dose (aPAD) varies with population; see individual reports
Daily totals for food and foodform consumption used.
MC iterations = 10      MC list in residue file     MC seed = 10
Run Comment: "Anticipated residues"
================================================================================

Summary calculations (per capita):

      95th Percentile             99th Percentile             99.9th Percentile
 Exposure  % aPAD     MOE    Exposure  % aPAD     MOE    Exposure  % aPAD     MOE
---------- ------- -------- ---------- ------- -------- ---------- ------- --------
U.S. Population:
  0.000536   21.45     466    0.000936   37.45     267    0.001708   68.33     146
All infants:
  0.000545   68.11     458    0.001382  172.73     180    0.001916  239.52     130
```

TABLE 7.5 (CONT'D)

Novigen Sciences, Incorporated Ver. 7.06
DEEM ACUTE analysis for NOVICHEM (1994-96 data)
Residue file: acute7mc.RS7 Adjustment factor #2 NOT used.
Analysis Date: 02-03-2000/15:43:59 Residue file dated: 02-03-2000/15:38:17/1
NOEL (Acute) = 0.250000 mg/kg body-wt/day
Acute Reference Dose (aRfD) = 0.002500 mg/kg body-wt/day
Daily totals for food and foodform consumption used.
MC iterations = 10 MC list in residue file MC seed = 10
Run Comment: "Anticipated residues"

U.S. Population — Daily Exposure Analysis 1/ (mg/kg body-weight/day)

	per Capita	per User
Mean	0.000178	0.000179
Standard Deviation	0.000199	0.000199
Margin of Exposure 2/	1,401	1,393
Percent of aRfD	7.13	7.18

Percent of Person-Days that are User-Days = 99.40%

Estimated percentile of user-days falling below calculated exposure in mg/kg body-wt/day with Margin of Exposure (MOE) and Percent of aPAD

Perc.	Exposure	% aRfD	MOE	Perc.	Exposure	% aRfD	MOE
10.00	0.000016	0.62	16,063	90.00	0.000401	16.04	623
20.00	0.000036	1.44	6,945	95.00	0.000537	21.49	465
30.00	0.000062	2.48	4,030	97.50	0.000688	27.50	363
40.00	0.000092	3.69	2,707	99.00	0.000938	37.51	266
50.00	0.000126	5.02	1,990	99.50	0.001141	45.65	219
60.00	0.000164	6.54	1,528	99.75	0.001342	53.69	186
70.00	0.000210	8.38	1,192	99.90	0.001711	68.43	146
80.00	0.000277	11.08	902				

Estimated percentile of per-capita days falling below calculated exposure in mg/kg body-wt/day with Margin of Exposure (MOE) and Percent of aPAD

Perc.	Exposure	% aRfD	MOE	Perc.	Exposure	% aRfD	MOE
10.00	0.000015	0.58	17,213	90.00	0.000400	16.00	624
20.00	0.000035	1.40	7,167	95.00	0.000536	21.45	466
30.00	0.000061	2.43	4,107	97.50	0.000687	27.47	364
40.00	0.000091	3.65	2,743	99.00	0.000936	37.45	267
50.00	0.000125	4.98	2,006	99.50	0.001141	45.62	219
60.00	0.000163	6.50	1,537	99.75	0.001341	53.62	186
70.00	0.000209	8.35	1,198	99.90	0.001708	68.33	146
80.00	0.000276	11.03	906				

1/ Analysis based on all two-day participant records in CSFII 1994-96 survey.
2/ Margin of Exposure = NOEL/ Dietary Exposure.

TABLE 7.5 (CONT'D)

```
Novigen Sciences, Incorporated                                        Ver. 7.06
DEEM ACUTE analysis for NOVICHEM                                   (1994-96 data)
Residue file: acute7mc.RS7                          Adjustment factor #2 NOT used.
Analysis Date: 02-03-2000/15:43:59    Residue file dated: 02-03-2000/15:38:17/1
NOEL (Acute) =   0.250000 mg/kg body-wt/day
Acute Pop Adjusted Dose (aPAD) =   0.000800 mg/kg body-wt/day
Daily totals for food and foodform consumption used.
MC iterations = 10      MC list in residue file     MC seed = 10
Run Comment: "Anticipated residues"
================================================================================
```

All infants

Daily Exposure Analysis (mg/kg body-weight/day)	per Capita	per User
Mean	0.000116	0.000152
Standard Deviation	0.000240	0.000264
Margin of Exposure	2,149	1,648
Percent of aPAD	14.54	18.96

Percent of Person-Days that are User-Days = 76.68%

Estimated percentile of user-days falling below calculated exposure in mg/kg body-wt/day with Margin of Exposure (MOE) and Percent of aPAD

Perc.	Exposure	% aPAD	MOE	Perc.	Exposure	% aPAD	MOE
10.00	0.000001	0.09	364,342	90.00	0.000417	52.15	599
20.00	0.000009	1.11	28,105	95.00	0.000600	75.03	416
30.00	0.000034	4.30	7,267	97.50	0.001000	125.00	250
40.00	0.000053	6.68	4,681	99.00	0.001441	180.07	173
50.00	0.000064	7.99	3,909	99.50	0.001756	219.55	142
60.00	0.000078	9.77	3,197	99.75	0.001777	222.19	140
70.00	0.000105	13.12	2,381	99.90	0.001919	239.85	130
80.00	0.000209	26.18	1,193				

Estimated percentile of per-capita days falling below calculated exposure in mg/kg body-wt/day with Margin of Exposure (MOE) and Percent of aPAD

Perc.	Exposure	% aPAD	MOE	Perc.	Exposure	% aPAD	MOE
10.00	0.000000	0.00	>1,000,000	90.00	0.000342	42.81	729
20.00	0.000000	0.00	>1,000,000	95.00	0.000545	68.11	458
30.00	0.000000	0.04	840,723	97.50	0.000760	95.01	328
40.00	0.000011	1.39	22,548	99.00	0.001382	172.73	180
50.00	0.000042	5.20	6,007	99.50	0.001747	218.37	143
60.00	0.000062	7.80	4,004	99.75	0.001770	221.29	141
70.00	0.000079	9.92	3,150	99.90	0.001916	239.52	130
80.00	0.000133	16.63	1,879				

Acute Critical Exposure Commodity Analysis

The DEEM™ Acute Module allows the user to conduct sensitivity analyses, via the Acute Critical Exposure Commodity (CEC) Analysis to determine those foods that contribute most to the total exposure of all individuals with exposure levels between user-specified percentiles (between 95th percentile and the maximum exposure). The user can determine whether a particular food, residue level or individual food "drives" the assessment, and whether more than one food contributes to most of the exposure of the selected individuals.

Please note that if the advanced CEC functions have not been licensed, several of the CEC capaibilities will be unavailable, including: The commodity-level summary at the top of the CEC report; the ability to specify an upper bound other than 100%; the ability to perform "Redo Last CEC".

The user chooses the maximum number of records to be included in the CEC file, e.g., 100. (This number is applied to each population, so that you will get 100 records for each population included in the analysis). The records saved to the report are for the 100 highest exposure amounts in the entire analysis; however, only those records in the top 5% or less of actual (as opposed to per-capita) daily exposures will be included. Thus, if you ask for 100 records and only 92 records show up for a given population, this means that only 92 records were in the top 5%.

The number of individual exposure records that can be included for each subpopulation in a CEC report is limited to 500. But these are printed records, not representative records, because exposure records for an individual are saved and printed only if they have a unique exposure amount. The number of times each exposure amount is computed for the same person-day is included (along with demographic information) with the exposure amount. Previously you did not know whether a given exposure amount in the CEC file represented one or many hits for the same person-day.

The CEC file lists both the number of printed records and the number of records represented (i.e., including multiple occasions for the same exposure amount for the same person in an MCA). (Theoretically, the total daily exposure number reported for an individual in the CEC file may be made up of different combinations of food consumption amounts and residues in different iterations in the MCA. However, the probability of this occurring is small and not likely to affect the general conclusions that can be drawn from an examination of the CEC file).

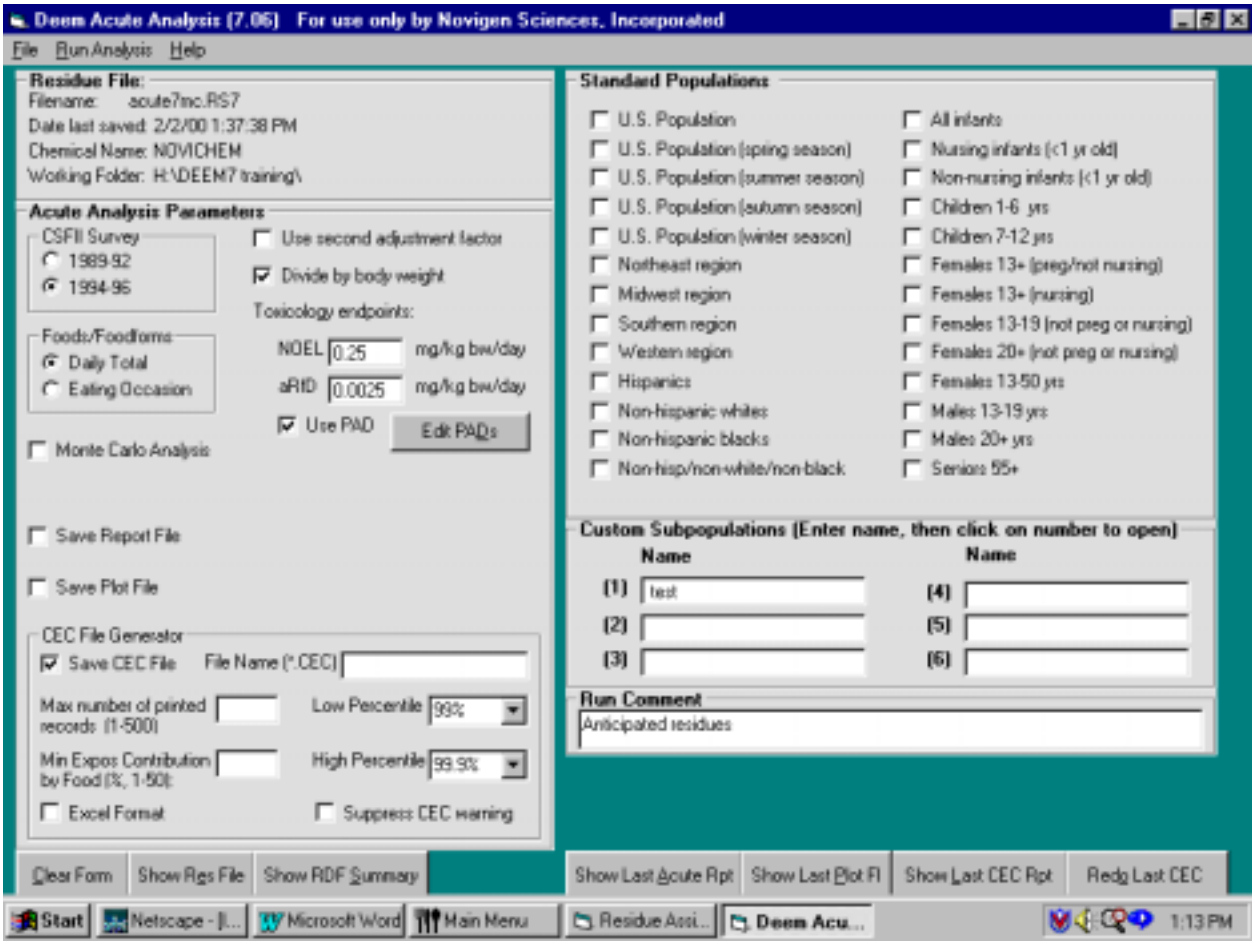
The number of records represented (rather than the number printed) is used in the summary statistics for each population. These summary statistics include the number of times a given food-foodform appears in the CEC records for each population, and the percent of the total exposure represented by all of the records for a given population that is made up by a given food-foodform. These summary statistics by food/foodform are printed in descending order of significance (based on the number of times that the food-foodform appears in the file for the population).

Two CEC data formats are available to the user:

(1) *.CEC, text file (Table 7.6) where the user demographics and total daily exposure are printed on one line and the following lines contain the rac-foodform contributions to the exposure; and
(2) *.CSV, an "Excel" ready format which provides demographic data and total daily exposure followed by the first rac-food form contributions, then repeated on the immediately following lines for the second, third, etc. rac-foodform.

The first is more adaptable to viewing directly on screen or printing in a report; the second can be directly loaded into Excel (as a CSV file) with no modifications and all columns are aligned. The user chooses the format when launching the analysis.

After a residue file is loaded, a check box labeled “Save CEC File” appears on the screen. If this box is selected, then four text boxes appear (Screen 7.9).



Screen 7.9: CEC Options

(1) CEC file name: As with the Acute analysis file name, if you do not include a path the file will be saved to the default residue directory. CEC files always have the extension "CEC." (Note, if Excel Format is selected, the file will have the extension CSV.)
(2) Maximum CEC records (1-500). This is the maximum number of individual exposure records that can be saved to a CEC file.
(3) Minimum Contribution (1% to 50%): Only foods\foodforms that contribute more than this percentage amount to an individual's total exposure will be included in the CEC file.
(4) Low/High Percentiles: User-specified to determine commodities contributing to exposure between these percentiles.

The "Show Last CEC Rpt" button at the bottom of the DEEM™ Acute Analysis screen allows the user to view the last CEC (or CSV) file generated. This button appears only when the "Save CEC File" check box is displayed and selected. Using this button, the user can display the CEC file to the screen, send it to the printer, or save this file to disk.

The "Redo Last CEC" button permits the user to change parameters for the CEC (e.g., different percentiles, different percentage of exposure) WITHOUT having to rerun the analysis. It is also possible to change the format from a CEC to a CSV, simply by clicking on Excel Format and "Redo Last CEC."

TABLE 7.6

CRITICAL EXPOSURE COMMODITY ANALYSIS
(*.CEC format)

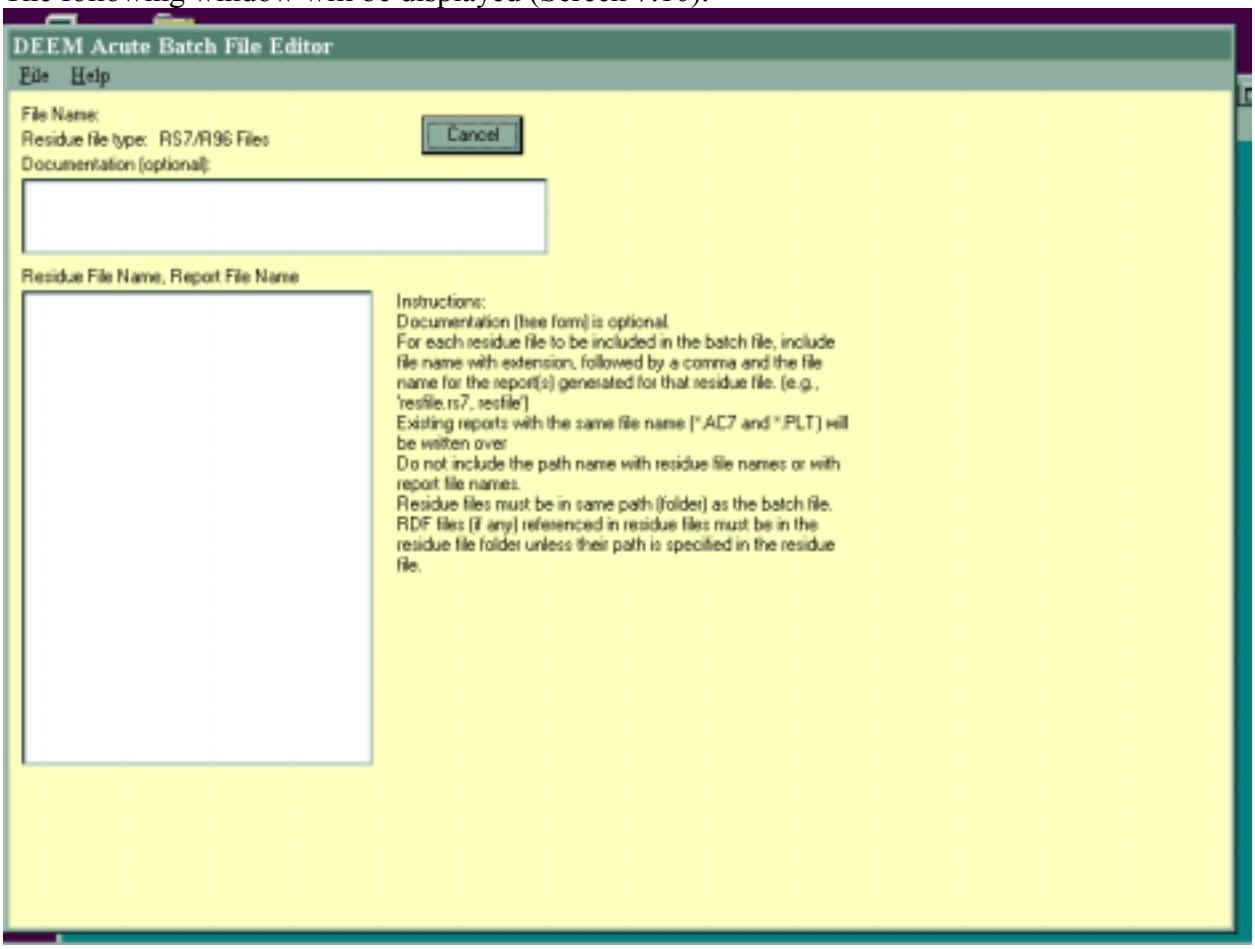
```
Novigen Sciences, Incorporated
DEEM Acute Critical Exposure Contribution Analysis (Ver 7.06)
CSFII 1994-96
Residue file = H:\DEEM7 training\acute7.RS7
Acute report = H:\DEEM7 training\acute7.AC7
Date and time of analysis: 02-02-2000 14:15:09
Daily totals for food and foodform consumption used.
Minimum exposure contribution = 10%
Exposures divided by body weight

Subpopulations:
   All infants

All infants
Low percentile for CEC records: 95     Exposure (mg/day) =    0.005233
High percentile for CEC records: 99.9  Exposure (mg/day) =    0.015530
Number of actual records in this interval: 22


Critical foods/foodforms for this population (as derived from these records):
  N=number of appearances in all records (including duplicates)
  %=percent of total exposure for all records (including duplicates)
Food   FF       N        %      Name
 65,   31,      19,    80.79,   Peaches-Canned: NFS
 65,   11,       2,     8.91,   Peaches-Uncooked
 64,   11,       1,     6.76,   Nectarines-Uncooked
402,   31,       2,     1.07,   Peaches-juice-Canned: NFS

Number of printed records = 10
Number of records represented = 10
 (nf = number of foods/ff reported for this daily exposure amount (exceeding minimum
contribution)
 (nx = number of times this exposure amount was computed for the same person on the
same day.)

Demographic data for each record:
   pid  day sex   age    bw-kg   nf   nx    tot expos   samplwt
 ------ --- ---   ---   ------   --  ----  -----------  -------

Exposure contribution data by food/ff consumed (nf lines):
   food  ff  amt(g)    residue   adj#1  adj#2   contributn  percnt
   ----  --  ------  ----------  -----  -----   ----------  ------

     620,  1,  M,   8M,    7.27,   1,    1,    0.013545,  11713
      65, 31,  163.2,   0.600000,  1.00,  1.00,    0.013464,  99.40

    1843,  2,  F,   8M,    7.27,   1,    1,    0.011365,  13992
      64, 11,  136.0,   0.600000,  1.00,  1.00,    0.011220,  98.73

    1539,  2,  M,   7M,    8.18,   1,    1,    0.010414,   9591
      65, 31,  139.4,   0.600000,  1.00,  1.00,    0.010223,  98.16

    1761,  1,  F,   9M,    9.55,   1,    1,    0.009967,  13959
      65, 11,  157.0,   0.600000,  1.00,  1.00,    0.009869,  99.02

     176,  1,  M,   5M,    6.82,   1,    1,    0.008473,   5727
      65, 31,   96.2,   0.600000,  1.00,  1.00,    0.008466,  99.91

     776,  2,  F,   9M,    7.27,   1,    1,    0.008162,  25040
      65, 31,   96.1,   0.600000,  1.00,  1.00,    0.007928,  97.14
```

TABLE 7.6 (CONT'D)

```
 801,  2,  M,   6M,    8.18,   1,    1,    0.007997,   6312
 65, 31,  105.5,   0.600000,  1.00,  1.00,    0.007737,  96.74

1359,  1,  M,   7M,    7.73,   1,    1,    0.007492,   8323
 65, 31,   96.4,   0.600000,  1.00,  1.00,    0.007485,  99.91

 620,  2,  M,   8M,    7.27,   1,    1,    0.007390,  11713
 65, 31,   81.6,   0.600000,  1.00,  1.00,    0.006732,  91.09

1280,  2,  F,   5M,    5.91,   1,    1,    0.007367,  31113
 65, 31,   72.3,   0.600000,  1.00,  1.00,    0.007341,  99.65
```

Batch Files

The DEEM™ acute program permits user to conduct a series of analyses using the batch mode option. To create a batch file, click on the "Edit Batch File" option on the Acute setup screen. The following window will be displayed (Screen 7.10).



Screen 7.10: Batch File Editor

To create a batch file, click on "File" then "Open New File." You will be prompted to name the batch file (the file will have the extension B96). You may enter any information on the documentation lines. The format for the files to include in the analyses must be (1) the residue file name (with RS7 or R96 extension) followed by a comma, then (2) the output file name.

Once the information has been completed, click "File" then "Save." To exit the Batch File Editor, click on "Exit."

Note that the residue files listed in the batch file must have either a NOEL or aRfD/aPAD value included in the header information if you select to divide the exposure estimate by body weight, otherwise, the program will not run.

If a Monte Carlo analysis is conducted for more than one residue file, the parameters assigned (i.e., number of iterations and seed) will be the same for all Monte Carlo analyses. Also, population groups selected will be the same for all analyses. It is possible to have both Monte Carlo and single-point acute analyses in the same batch file. Acute exposure anlyses calculated using the Batch mode are automatically saved to disk.

CHAPTER 8. WORKING WITH RDFgen™ AND PRE-EXTRACTED USDA PDP MONITORING DATA

8.1 PURPOSE

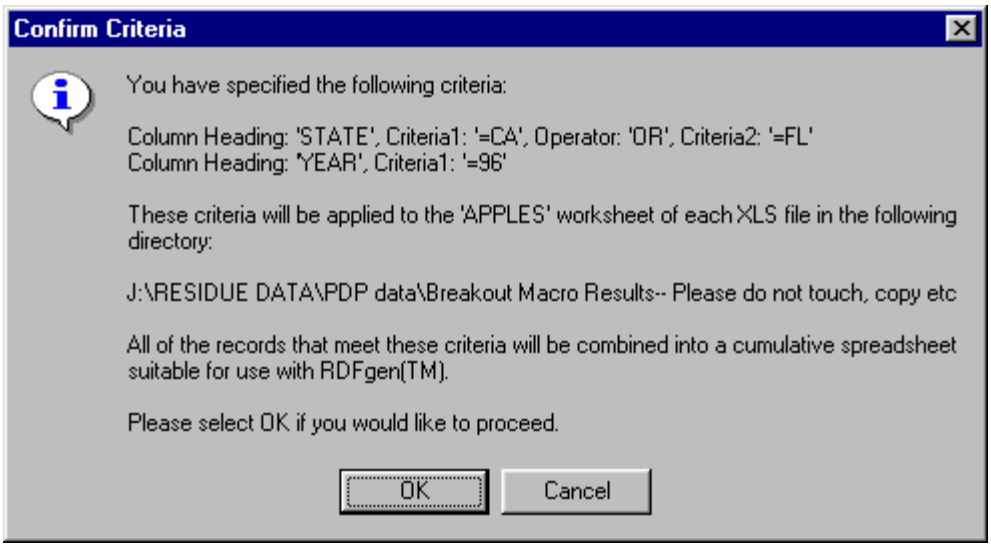
The RDFgen™ module of DEEM™ automates residue distribution adjustments and the creation of summary statistics and Residue Distribution Files (hereafter referred to as RDF files). Using the Residue File Editor, the mean value of an adjusted residue distribution calculated by RDFgen™ can be used in a chronic or acute risk assessment, or an RDF file generated by RDFgen™ can be referenced in an acute risk assessment. RDFgen™ can also perform cumulative residue adjustments and generate cumulative RDF files based on PDP data for samples that have been tested for multiple analytes.

For maximum speed and accuracy, Novigen maintains sets of spreadsheets containing up-to-date monitoring data from the most widely used source, the Pesticide Data Program of the U.S. Department of Agriculture. These sets of spreadsheets are ready for immediate use with RDFgen™, and are referred to by the following titles: "RDFgen™ Pre-extracted Individual Analyte Mode PDP Data Set" and "RDFgen™ Pre-extracted Cumulative Mode PDP Data Set".

Additionally, to allow creation of RDFgen™ Cumulative Mode or Individual Analyte Mode PDP residue input spreadsheets filtered for specific sample attributes (such as origin or date collected), Novigen maintains a pre-extracted data set integrating all PDP sample database and residue database information, plus the following helpful standardized fields:

- COMMOD_NAM (Translated version of the two-character COMMOD field, including separation of processed commodities that share COMMOD code with unprocessed commodities, such as green beans/processed green beans and peaches/canned peaches)
- FULL_PESTN (Standardized version of two-character PEST_NAME field)
- BOOKYEAR (PDP data annual report year to which the record belongs)
- YEARY2K (Ensures continued ability to correctly sort and query based on sample date)
- DETECT (Y/N field indicating whether sample is a detect or non-detect sample)
- ORIGINSTD (Standardized version of ORIGIN field, facilitating separation of domestic samples, imported samples, and samples of unknown origin)

This series of Excel workbooks is referred to as the RDFgen™ full Pre-extracted PDP Data Set. Creation of RDFgen™ Cumulative or Individual Analyte Mode PDP residue input spreadsheets containing user-defined subsets of the RDFgen™ full Pre-extracted PDP data set is automated by the RDFgen™ Input Generator™ Excel add-in.



Example Dialog From the RDFgen™ Input Generator™ Excel Add-in

RDFgen™ is closely integrated with USDA PDP pesticide monitoring data because it is the most widely used source of pesticide residue data. The merits of the PDP data for use in dietary risk assessments include:

- Rigorous statistical design
- **Many samples are taken of heavily consumed commodities over multi-year periods**
- Sensitive methods
- All analyzed samples (detects and non-detects) are explicitly reported
- Good quality assurance
- Most samples are tested for multiple analytes, enabling cumulative residue operations

8.2 DISTRIBUTION ADJUSTMENTS AND MODES

RDFgen™ can operate in either of two primary modes: Individual Analyte Mode and Cumulative Mode. Individual Analyte mode allows the user to perform either or both of the following residue adjustments on any single analyte residue distribution:

- Percent Crop Treated
- Decompositing

Cumulative mode allows the user to perform any of the following residue adjustments on any combination of compounds, provided that individual samples have been tested for co-incident residues:

- Percent Crop Treated
- Decompositing
- Relative Potency
- Processing Factors

RDFgen™ may be launched from within DEEM™ or using a shortcut in Windows®. To launch RDFgen™ using a shortcut in Windows®, click on the Windows® Start menu, select Programs, then click on the RDFgen™ icon, as in Figure 8.1, or double-click the RDFgen™ icon on the Desktop if you have created one. To launch RDFgen™ from within DEEM™, select "RDFgen" in the menu bar of the DEEM™ main menu screen, then click on "Run RDFgen" (Figure 8.2).

Figure 8.1: Launching RDFgen™ from the Windows® Start menu.

Figure 8.2: Launching RDFgen™ from DEEM™.

Figure 8.3 will be displayed. Enter your DEEM™ password, then press [Enter] or click OK. *Note: Both DEEM™ and Microsoft Excel® 97 must be properly installed on your computer in order to use RDFgen™. If Microsoft Excel® 97 is not properly installed on your computer, RDFgen™ will simply not be able to run. The first time RDFgen is launched after installation, it will detect the location of the DEEM program files on your computer if they are installed in "C:\DEEM\" or "C:\Program Files\Novigen\DEEM\". If DEEM is installed in a non-standard directory on your computer, you will need to specify the correct path to the DEEM program files directory by clicking in the upper text field. An Open dialog will pop up, allowing you to navigate to the appropriate directory.*

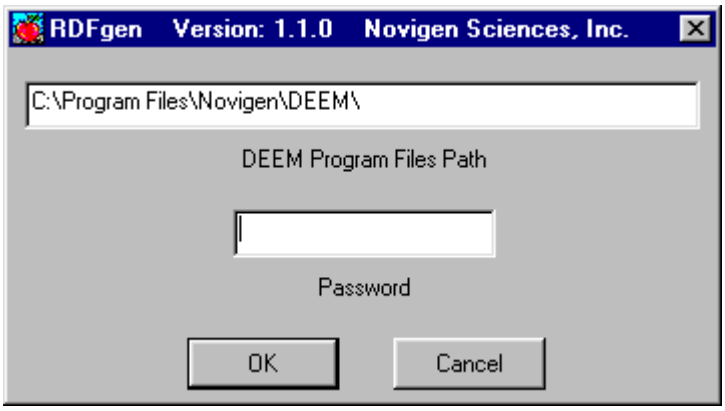


Figure 8.3: RDFgen™ opening screen.

After successfully entering your DEEM™ password, the screen shown in Figure 8.4 will appear.

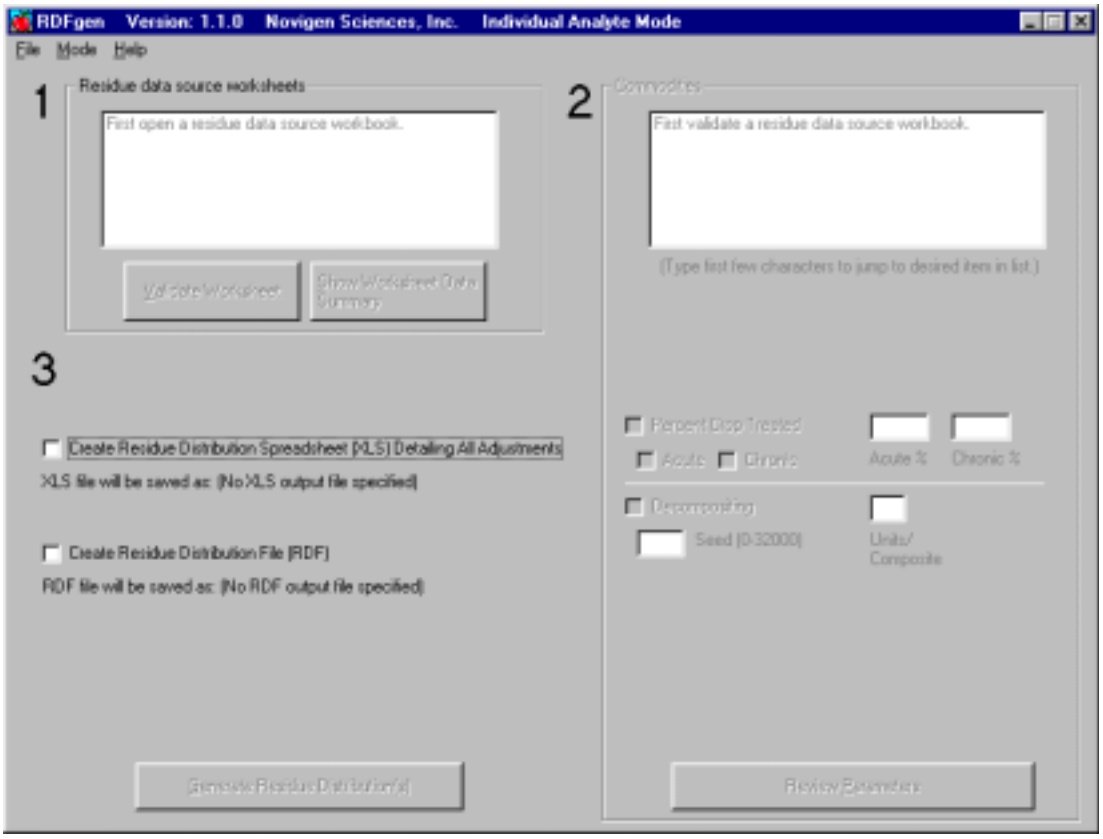


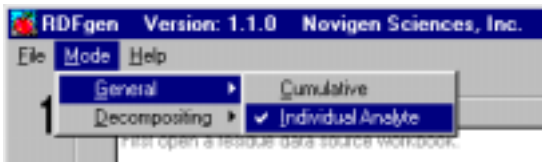
Figure 8.4: RDFgen™ main screen, Individual Analyte Mode

Notice that most of the controls are grayed out. In order to enable them, you will first need to open a residue data source workbook and validate a worksheet.

PERFORMING PERCENT CROP TREATED AND DECOMPOSITING ADJUSTMENTS FOR AN INDIVIDUAL ANALYTE USING RDFGEN™ AND THE PRE-EXTRACTED PDP DATA SET FORMATTED FOR RDFGEN™ INIDIVIDUAL ANALYTE MODE

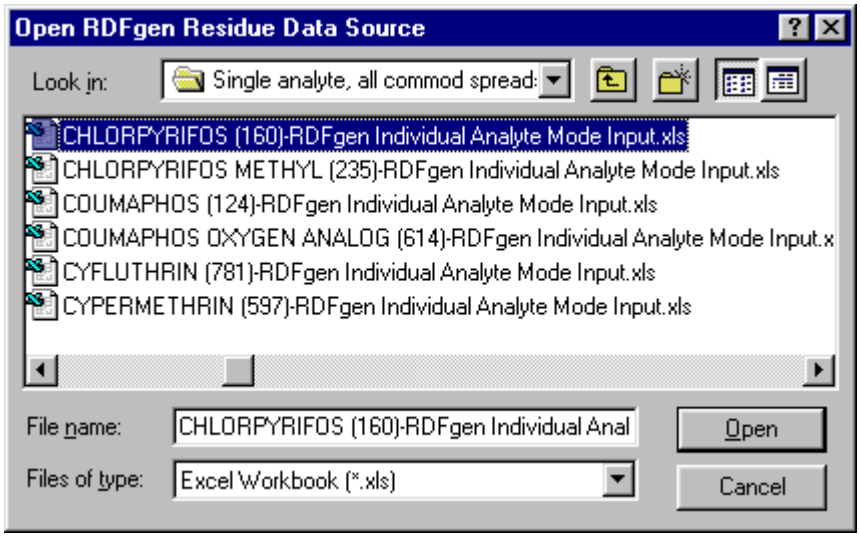
The following example can be used as a guide to using RDFgen™ Individual Analyte Mode and understanding its output files (Excel® spreadsheets and Residue Distribution Files). It also demonstrates how easily residue distribution adjustments can be performed on the pre-extracted PDP data. *Note: The values specified for Percent Crop Treated and Units Per Composite in this example are fictitious.*

1) In the RDFgen™ main screen, ensure that Individual Analyte Mode is activated.

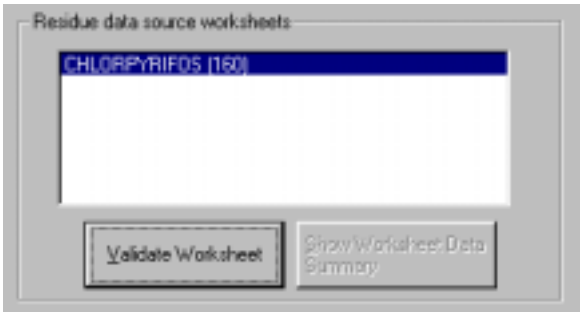


2) Select File→Open, or press [Control] + O. *Note: Virtually every feature of RDFgen can be controlled using either the mouse or the keyboard. These instructions will focus on using the mouse, but the device you use is a matter of preference. Many users find that they work most efficiently using a combination of mouse and keyboard to navigate the controls in RDFgen™. To use the keyboard, note that you can activate the subsequent or previous control on the screen by pressing using [Tab] and [Shift] + [Tab]. You can also activate some controls by pressing [Alt] and the underlined shortcut character. Buttons can be "clicked" by pressing [Enter], while check boxes can be toggled by pressing the space bar.*

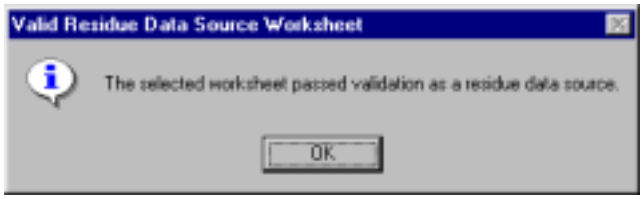
3) If you have used RDFgen™ since installing it, the "Open RDFgen Residue Data Source" screen that pops up will start in the same directory you obtained your last source residue data workbook from, assuming that directory is still available. Navigate to and select the source residue data workbook of your choice, and click the "Open" button., or simply double-click on the residue data workbook.



4) Select the worksheet you are interested in and click the "Validate Worksheet" button. (*Note that there is only one worksheet per source residue data workbook in the Pre-extracted PDP data set formatted for RDFgen™ Individual Analyte Mode.)*



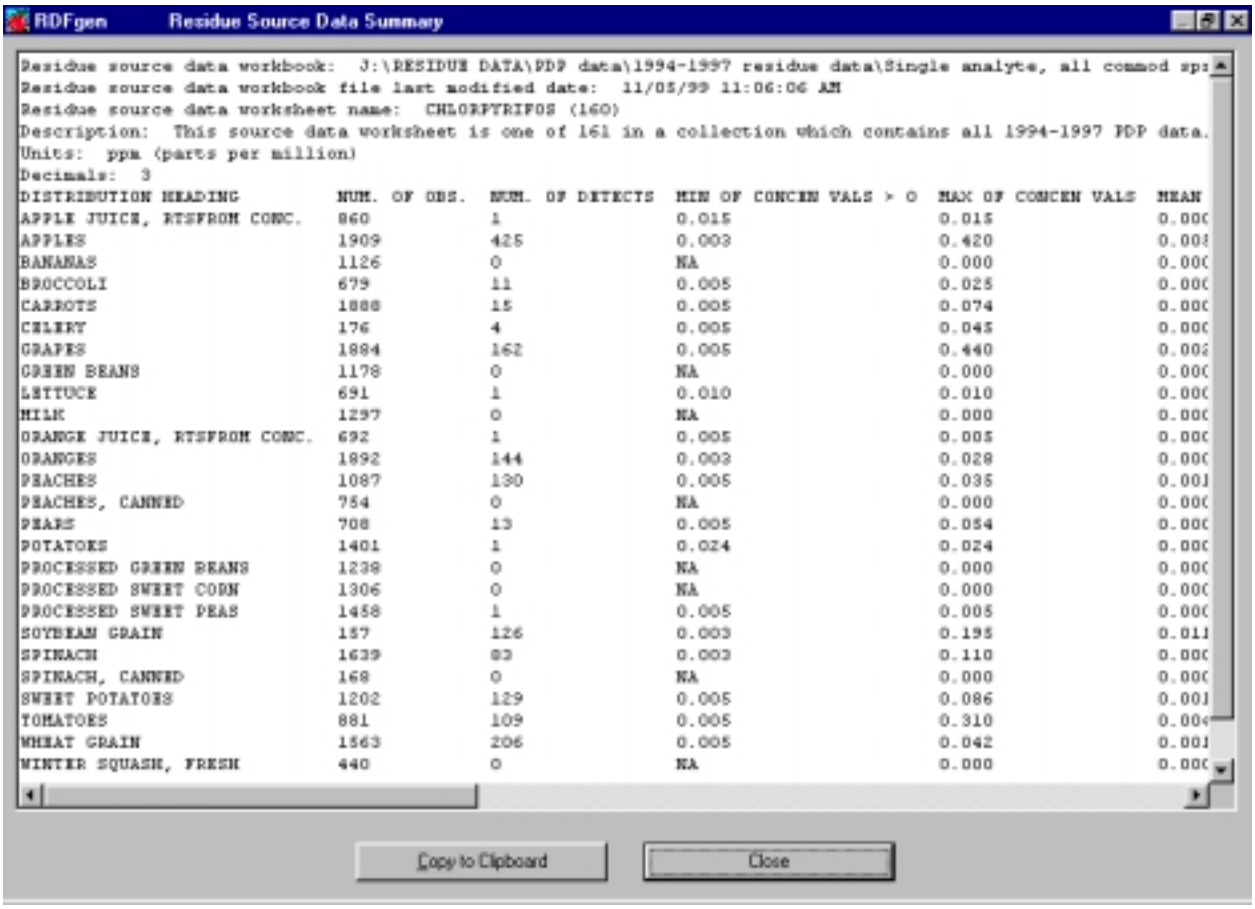
5) Assuming the worksheet passes validation, you will receive a message like this:



6) Click OK on the validation confirmation message.

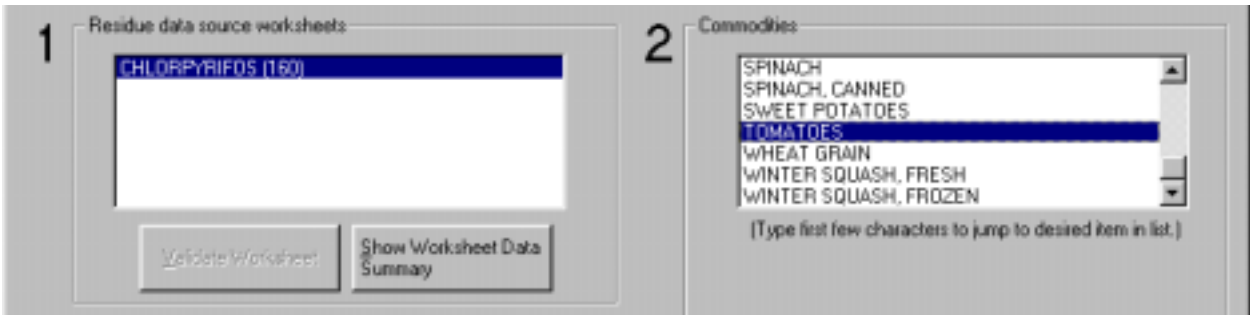
7) If you like, you may now click on the "Show Worksheet Data Summary" button to see details about the data source you have selected.

8) The Worksheet Data Summary starts with basic information about the selected source workbook and worksheet. It then displays any information specified in the source worksheet Parameter Cell (this can include any combination of Description, Units and Decimals). Finally, summary statistics are given for each residue distribution in the selected source worksheet. *Note: The Worksheet Data Summary will ultimately be included in your residue distribution spreadsheet output should you choose to have RDFgen create spreadsheet output.*



9) Click the "Close" button to return to the RDFgen™ main screen.

10) Select the commodity you are interested in from the list in the upper-right area of the screen. (You can jump to the item of interest by typing the first few characters, but you must first click on the list to make it the active control.)



11) Click on the "Percent Crop Treated" checkbox if you would like to perform this type of adjustment (you may then uncheck either the "Acute" or the "Chronic" checkbox if you do not want to perform that type of adjustment).

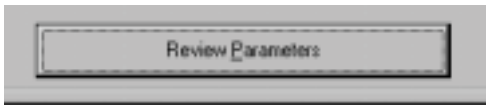
12) Fill in the Acute and Chronic Percent Crop Treated values for the selected commodity.

13) Click on the "Decompositing" checkbox if you would like to perform this type of adjustment. Please note that RDFgen™ can not warn you if you are preparing to decomposite a distribution for an inappropriate commodity, such as a blended commodity. It is up to the user to determine what adjustments are appropriate.

14) Fill in a Seed value between 1 and 32,000 (inclusive) for the random number generator, or enter a zero of you would like the computer to create the seed dynamically using the CPU timer. *Note: The ability to specify a seed for the random number generator is given to allow replication of results despite the fact that the decompositing algorithm requires sequences of random numbers. Be aware that to duplicate the results, more than just the seed needs to be set the same: The exact same source distribution must be used, and all other entered parameters must be identical, including Percent Crop Treated and Units Per Composite.*

15) Fill in a value for Units Per Composite.

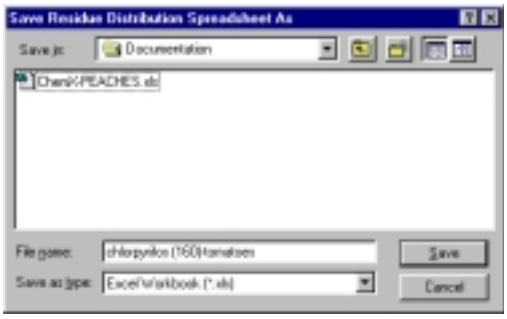
16) If you like, you can click on the "Review Parameters" button to review the parameters you have specified.



17) The Parameter Summary starts with an indication of the mode RDFgen™ is in and the commodity distribution that has been selected. Below the "Selected Adjustments" heading, the type(s) of adjustment(s) that you have selected and the corresponding parameters are documented. *Note: The Worksheet Data Summary will ultimately be included in your residue distribution spreadsheet output should you choose to have RDFgen create spreadsheet output.*

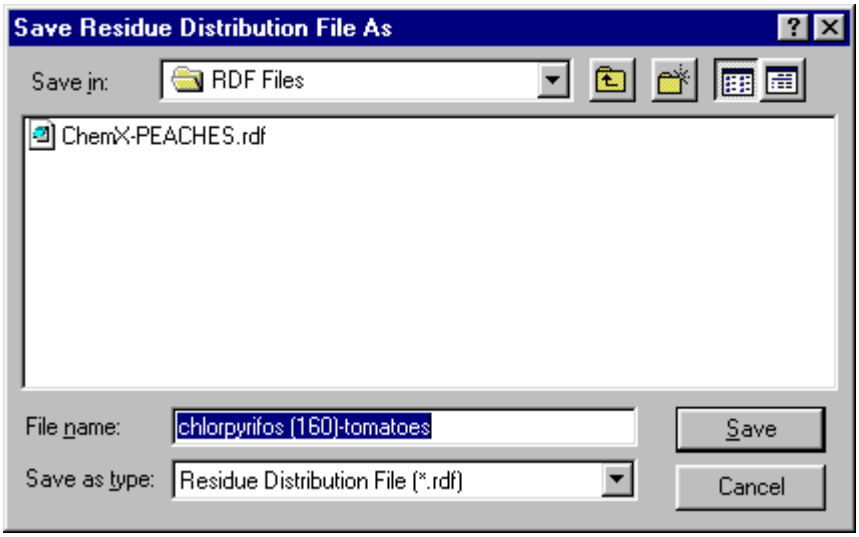
18) Click the "Close" button to return to the RDFgen™ main screen.

19) If you would like output documenting the adjustments performed and showing the data at each phase of adjustment, then click on the check box labeled "Create Residue Distribution Spreadsheet (XLS) Detailing All Adjustments". The following screen will pop up:



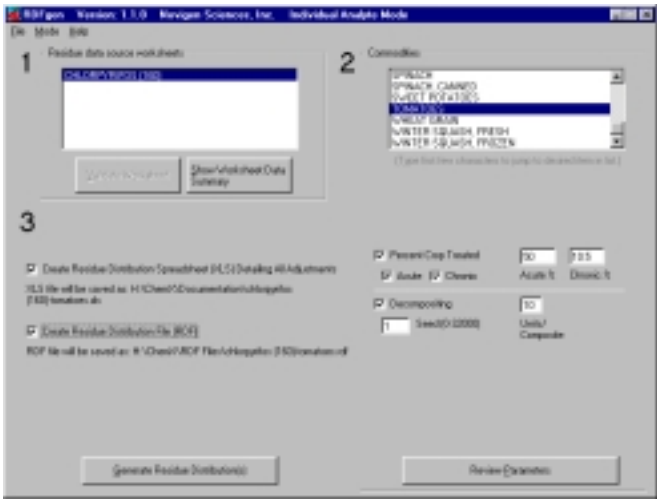
20) If you have used RDFgen™ since installing it, this screen will start in the same directory you saved your last Residue Distribution Worksheet output into, assuming that directory is still available. Type the file name of your choice, or accept the default file name offered by RDFgen™, and click the "Save" button. *Note that no file will actually be saved until you click the "Generate Residue Distribution(s)" button.*

21) If you would like to create a Residue Distribution File containing residue a distribution adjusted for Acute Percent Crop Treated and/or Decompositing, then click on the checkbox labeled "Create Residue Distribution File (RDF)". The following screen will pop up:

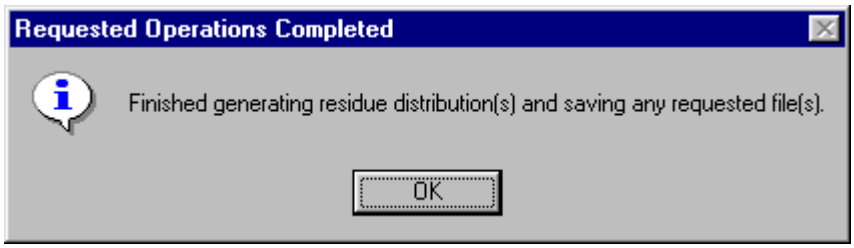


22) If you have used RDFgen™ since installing it, this screen will start in the same directory you saved your last Residue Distribution File into, assuming that directory is still available. Type the file name of your choice, or accept the default, and click the "Save" button. *Note that no file will actually be saved until you click the "Generate Residue Distribution(s)" button.*

23) You are now ready to set RDFgen™ to work!



24) Click the "Generate Residue Distribution(s)" button, and wait until the progress window in the middle of the screen disappears and a success message (or other message, such as a message confirming any file overwrite) pops up.



25) View the output file(s) that were generated the same way you normally view RDF and XLS files. RDF files are plain text files that should be viewed using a text editor like Microsoft Notepad (not a word processor like WordPerfect® or Word®). XLS files should be viewed using Microsoft Excel® 97 or later. You may minimize RDFgen™, close it, or simply leave it as is when viewing output files.

8.3 INPUT SPREADSHEET SPECIFICATION

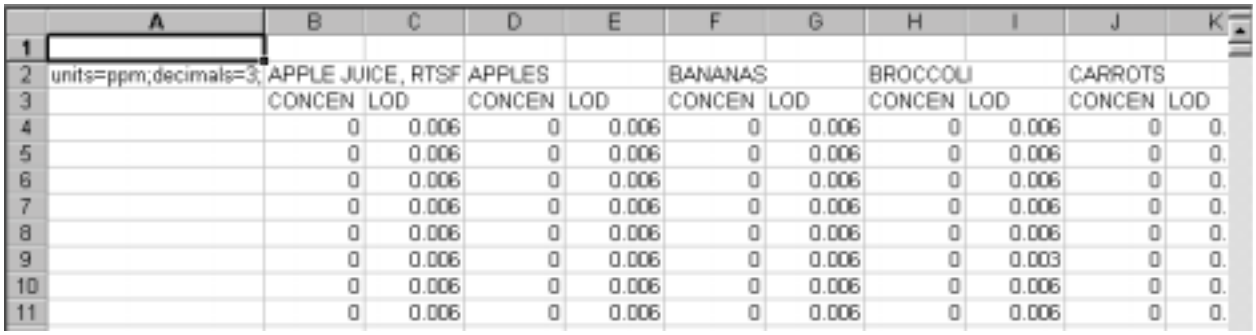
RDFgen™ accepts as input any residue data spreadsheet that has been formatted according to one of two pre-defined specifications. In general, Individual Analyte Mode input spreadsheets contain distributions for various commodities tested for a particular chemical, while Cumulative Mode input spreadsheets contain distributions for various chemicals tested on a particular commodity. Although the two specifications are similar, the specification for Cumulative Mode input spreadsheets features additional requirements beyond those of the Individual Analyte Mode input spreadsheet specification. As a result, it is important to keep in mind the following rule: Although all valid Cumulative Mode input spreadsheets will pass validation when RDFgen™ is in Individual Analyte Mode, not all valid Individual Analyte Mode input spreadsheets will pass validation when RDFgen™ is in Cumulative Mode.

Example of a Cumulative Mode input spreadsheet, containing a unique listing of alphanumeric sample IDs in column A, beginning at Row 4.

	A	B	C	D	E	F	G	H
1								
2	units=ppm;decimals=3;des	1 NAPHTHOL (382)		2 4-D (026)		4-HYDROXYDIPHENYLAMINE (AAH)		ACEPHAT
3	SAMPLEID	CONCEN	LOD	CONCEN	LOD	CONCEN	LOD	CONCEN
4	MI19940209038APPLES	0	0.03	0	0.006			
5	MI19940209025APPLES	0	0.03	0	0.006			
6	MI19940119016APPLES	0	0.03	0	0.006			
7	MI19940119037APPLES	0	0.03	0	0.006			
8	MI19940119040APPLES	0	0.03	0	0.006			
9	MI19940119004APPLES	0	0.03	0	0.006			
10	MI19940119047APPLES	0	0.03	0	0.006			
11	MI19940208008APPLES	0	0.03	0	0.006			

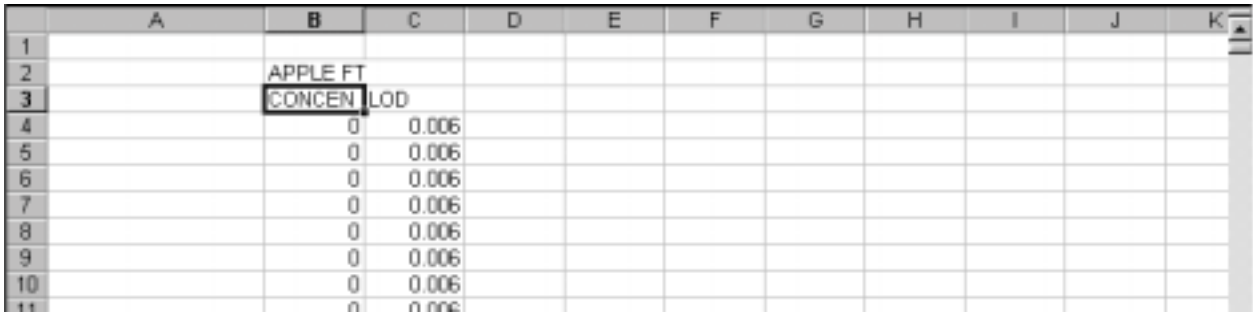
This format supports data on co-incident residues for samples. Typically, a single spreadsheet features data for many analytes tested on a single commodity. Note that in Cumulative Mode, RDFgen™ will only utilize samples where residue is available for all analytes selected by the user.

EXAMPLE OF AN INDIVIDUAL ANALYTE MODE INPUT SPREADSHEET, CONTAINING NO SAMPLE IDENTIFIERS AND HAVING NO CORRELATION OF RESIDUE DATA ACROSS ROWS:



	A	B	C	D	E	F	G	H	I	J	K
1											
2	units=ppm;decimals=3;	APPLE JUICE, RTSF		APPLES		BANANAS		BROCCOLI		CARROTS	
3		CONCEN	LOD	CONCEN	LOD	CONCEN	LOD	CONCEN	LOD	CONCEN	LOD
4		0	0.006	0	0.006	0	0.006	0	0.006	0	0.
5		0	0.006	0	0.006	0	0.006	0	0.006	0	0.
6		0	0.006	0	0.006	0	0.006	0	0.006	0	0.
7		0	0.006	0	0.006	0	0.006	0	0.006	0	0.
8		0	0.006	0	0.006	0	0.006	0	0.006	0	0.
9		0	0.006	0	0.006	0	0.006	0	0.003	0	0.
10		0	0.006	0	0.006	0	0.006	0	0.006	0	0.
11		0	0.006	0	0.006	0	0.006	0	0.006	0	0.

Typically, a single spreadsheet features data for many commodities tested for a single analyte. However, it is perfectly allowable to quickly create an RDFgen™ Individual Analyte Mode input spreadsheet based on the user's own residue data containing only a single distribution. An input spreadsheet created by the user can look as simple as this:



	A	B	C	D	E	F	G	H	I	J	K
1											
2		APPLE FT									
3		CONCEN	LOD								
4		0	0.006								
5		0	0.006								
6		0	0.006								
7		0	0.006								
8		0	0.006								
9		0	0.006								
10		0	0.006								

Using the Parameter Cell (cell A2). The Parameter Cell is supported in both Cumulative and Individual Analyte Modes. The Parameter Cell's three supported keywords ("units", "decimals", and "description") can provide RDFgen™ and the user of the residue data spreadsheet three types of information:

- "units=": PPM, PPB, or PPT (not case sensitive). RDFgen will report on the units used in the source data and will adjust values as appropriate when producing RDF files, since RDF files must be expressed in ppm. If the units keyword is omitted from the Parameter Cell, or if an unrecognized unit is specified, then creation of RDF files will be disabled when the input spreadsheet is used in RDFgen™.
- "decimals=": Specifies the number of places to the right of the decimal that the input data is accurate to.

- "description=": Any text string that does not include any semicolons (;) and does not exceed 255 characters in length (any characters beyond the first 255 will be truncated in spreadsheet-based output from RDFgen™).

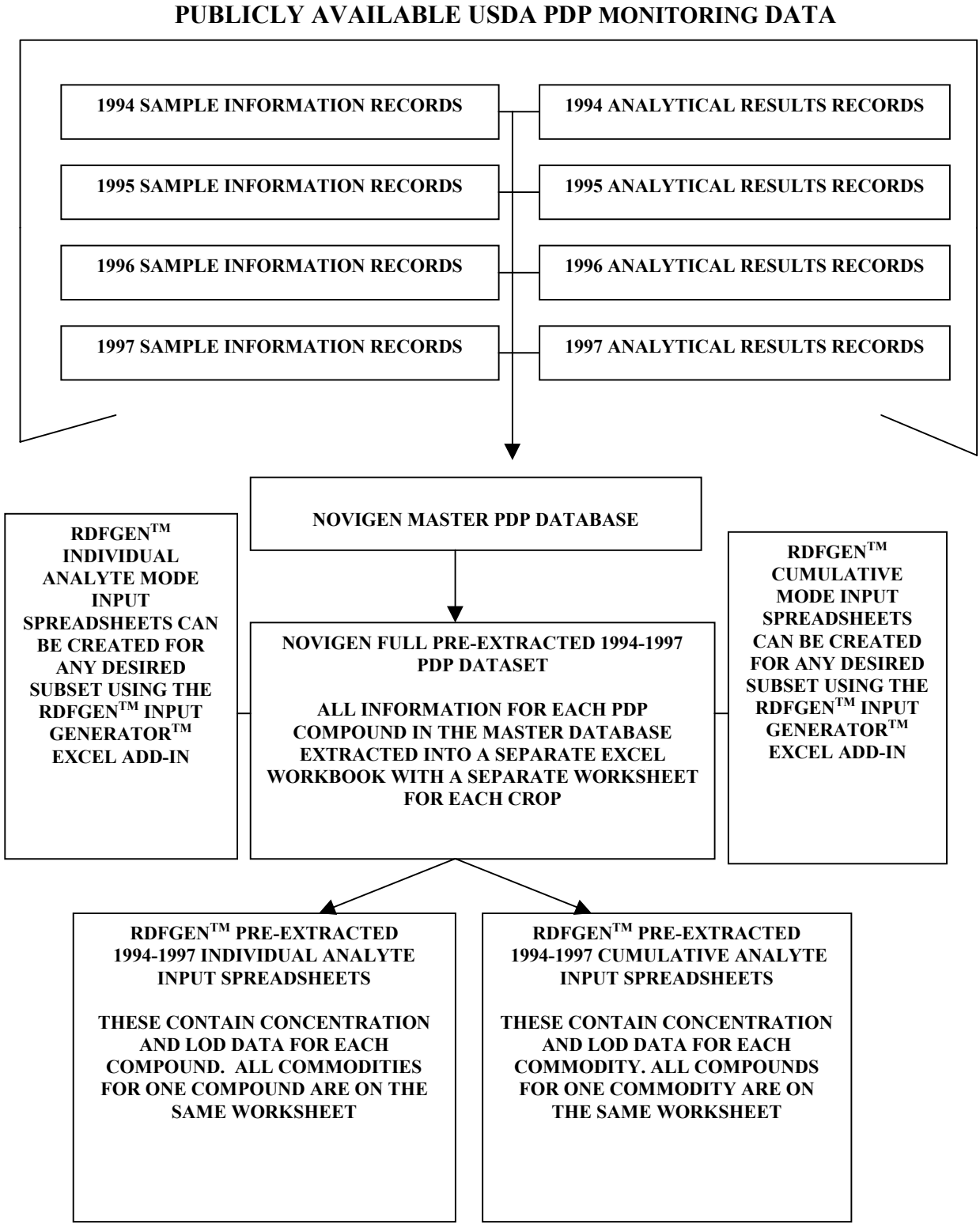
A typical Parameter cell might read as follows (note that any combination or all of the keywords may be included):

> units=ppm;decimals=3;description=This source data worksheet is one of 161 in a collection which contains all 1994-1997 PDP data. Each worksheet in this collection contains all of the residue data for one chemical. No samples have been omitted. Any data subsets must be created separately.

8.4 ABOUT THE PRE-EXTRACTED PDP MONITORING DATA

The RDFgen ™ pre-extracted PDP monitoring data, at the time of this writing, contains all of the 1994-1997 PDP data. Novigen will integrate PDP data for years subsequent to 1997 once USDA releases them. Please note that since all samples have been included, any data subsets need to be created separately by the user (this can be accomplished quickly and accurately using the RDFgen™ full Pre-extracted PDP data set with the RDFgen™ Input Generator™ Excel add-in). The pre-extracted data was compiled from the raw individual sample and residue databases distributed by the USDA PDP (see Chart 1). Because the records from the two USDA tables are linked using unique sample identification numbers, each record in combined RDFgen™ full Pre-extracted PDP data set contains both analytical result data and sample information. The pre-extracted PDP residue data sets accompanying RDFgen™ begin in 1994, since 1994 was the first year in which the PDP began using a standardized data format where all non-detect samples were explicitly presented in the database and LOD values were explicitly given for each sample. Finally, all Novigen pre-extracted PDP data sets have been compared record by record against the raw data supplied by the USDA PDP to assure integrity of the data.

CHART 1: OVERVIEW OF PROCESS USED TO PRODUCE PDP DATA SETS COMPATIBLE WITH INDIVIDUAL ANALYTE AND CUMULATIVE ANALYSES IN DEEM™



NOTE ON CONCENTRATION VALUES LESS THAN LOD: The 1994 and 1996 USDA PDP data include 81 samples with concentration values that are greater than zero but less than the corresponding reported Limit Of Detection (LOD). Novigen has confirmed the presence of these values with USDA representatives. If any RDFgen input spreadsheet contains one or more concentration values that are greater than zero but less than the corresponding LOD value, a notification message (see Figure 8.5) containing details of the instances will appear during the RDFgen worksheet validation process. The user will be given the option to override this warning and use the input data as is.

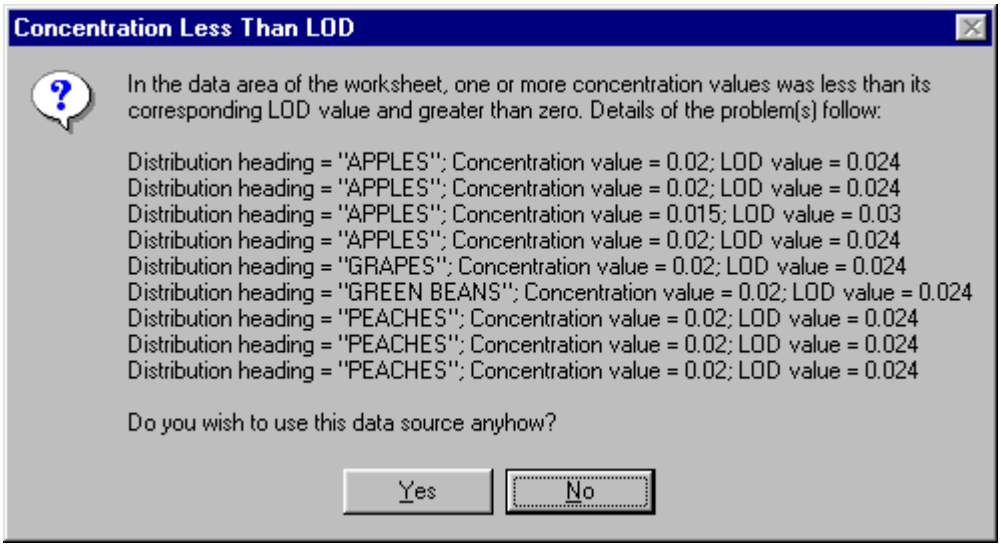


Figure 8.5: RDFgen™ non-zero concentration value less than LOD warning.

NOTE ON DUPLICATE RECORDS IN THE PDP DATA: The 1994, 1995 and 1996 USDA PDP data included in the Pre-Extracted PDP data sets contain 3,543 duplicate records, the vast majority of which (3,516) are for Thiabendazole data from 1995. These are records for which residue data for the same sample and the same analyte are reported more than once, potentially with different residue values. Novigen has confirmed the presence of these duplicate records with USDA representatives, and concurrently with the release of the 1998 PDP monitoring data, USDA has indicated the 1994 through 1996 data will be revised to eliminate these duplicate records. In the meantime, users are strongly cautioned against using the Pre-Extracted PDP data for any of the following analyte/commodity combinations:

DDT (TDE)/Carrots: 1 duplicate (1994)
DICOFOL/Potatoes: 3 duplicates (1994)
DICOFOL/Celery: 1 duplicates (1994)
PERMETHRINS/Lettuce: 2 duplicates (1994)
PERMETHRINS/Grapes: 20 duplicates (1996)
THIABENDAZOLE/Carrots: 690 duplicates (1995)
THIABENDAZOLE/Sweet Corn (Processed): 668 duplicates (1995)
THIABENDAZOLE/Grapes: 685 duplicates (1995)

THIABENDAZOLE/Oranges: 516 duplicates (1995)
THIABENDAZOLE/Peaches: 361 duplicates (1995)
THIABENDAZOLE/Spinach: 596 duplicates (1995)

8.5 MINIMUMS AND MAXIMUMS IN RDFGEN™

RDFgen enforces the following limits:

- Minimum number of samples in source distribution: 2
- Maximum number of samples in source distribution: 32,767
- Minimum number of units per composite when decompositing: 2
- Maximum number of units per composite when decompositing: 1,000
- Maximum number of decomposited samples (units per composite multiplied by number of samples in source distribution): 32,767
- Maximum source residue value: 1000 ppm
- Potency coefficient range (Cumulative Mode only): >0, ≤10,000
- Processing factor range (Cumulative Mode only): >0, ≤100
- Minimum seed value for random number generator: 1 (0 is also valid, but is used to request dynamic, timer-based seed)
- Maximum seed value for random number generator: 32,000
- Minimum number of residue distributions per input worksheet: 1 (Note that all residue distributions must contain concentration and LOD values.)
- Maximum number of distributions per input worksheet: 127 (determined by Excel® workspace specifications)
- Maximum number of worksheets per input workbook: 255 (determined by Excel® workspace specifications)

CHAPTER 9. AGGREGATE EXPOSURE ANALYSIS

Traditionally, the US EPA has assessed the potential risk associated with a chemical with multiple uses separately by source. The Food Quality Protection Act of 1996 (FQPA) has stressed the need for assessing the integrated exposure to chemicals, including dietary and non-dietary uses. The interim approach proposed by EPA uses the "risk cup" approach, whereby interim risk values are assigned to portions of the total risk for exposure through drinking water, residential uses and lawn treatment uses, while the remainder of the "risk cup" is left for dietary exposures. While extensive data are usually available for estimating dietary risk, the converse is not necessarily true for non-dietary exposures. Our Calendex™ model estimates potential exposures to multiple products by multiple exposure routes that allow for the derivation of realistic estimates of the integrated exposure. The model uses a probabilistic approach to estimating potential exposures.

Many pest control or consumer products that are used around the home may contain the same chemical compound. In addition, that same compound could be used on many agricultural commodities. An integrated exposure model, Calendex™ has been developed to estimate the potential for human exposure to multiple products by multiple exposure routes. This model estimates the daily total exposure potential when various products containing the same compound could be used in the same household and on food crops. The integrated exposure model provides more reasonable estimates of total exposure than simply summing maximum exposures for each individual product or use.

Personal characteristics, including, body weight, breathing rates, activity patterns, etc., vary not only between individuals, but may vary from day to day, or season to season, within individuals. Similarly, concentration levels vary depending on when and where they are measured, when and where the chemical was applied, the type of residence, etc. The uncertainty introduced by using single point estimates to represent these factors (whether average or upper percentile exposure level) increases with the number of variables used to derive these estimates. Thus, an assessment of the potential exposure to a chemical with one or more uses needs to take into consideration the variability in the factors affecting the exposure level. We propose an approach that uses Monte Carlo techniques to derive and combine exposure distributions from various uses with information about product use. The approach takes into account the probability that exposures to more than one product may occur on a single day, and provides a more realistic exposure assessment than would occur if exposures resulting from single uses are summed.

Since pesticide and consumer product usage may be seasonal, and since activity levels, and the amount of time spent indoors and outdoors may depend on the day of the week, we propose to use a calendar-based approach to derive the probability distribution of potential exposures. Since people are more likely to have exposures resulting from multiple product uses on some days than on others, this calendar-based model estimates exposures for every day of the year. These exposure distributions for individual days may also be combined into a distribution of daily exposure for all days of the year.

The model allows the assessment of major contributing factors to the overall exposure. Sensitivity analyses can be performed to show those factors that contribute most to the variability in the exposure distributions and where additional data may be needed to better define the exposure estimates.

The model estimates the distribution of the daily exposures that could result from each of the product use types. These distributions are then combined to derive an estimate of the distribution of daily integrated exposures that could result from all uses.

9.1 MODEL INPUT PARAMETERS

A. Non-dietary uses

- The types of data needed generally fall into four categories:

- Personal exposure measurements/environmental concentration data on days before, during and after treatment.

- Exposure factors such as body weight and breathing rate.

- Personal and environmental factors such as activity patterns, residence type and probability that a person applies the product himself or has a professional apply the product.

- Market use data provides information on market share of the products, frequency of application and amount of product applied.

Distributions of input parameters are used in the model where sufficient data are available, otherwise point estimates may be used.

Market use information can be used to define the "typical" patterns for the uses considered in the assessment, and to estimate the likelihood that a house receives one or more treatments in a given year. In addition, since some treatments can be applied either by professional applicators or by the homeowners (or residents), the market use information can be used to estimate the proportions of "professional" and "self" treatments, if necessary.

B. Dietary uses

The types of data generally needed fall in two categories:

- Consumption data, such as those derived from USDA's 1989-1992 Continuing Survey of Intake by Individuals (CSFII).

- Residue concentration data collected through monitoring programs or field trial studies. In the absence of sufficient monitoring data or field trial studies, tolerances can be used.

9.2 MODEL OUTPUTS

The model outputs consist of estimates of the distributions of daily integrated exposure (dermal, inhalation and ingestion). In addition, an estimate of the overall annual distributions of daily exposures is derived. The estimates can be derived for the entire US population, and for the population subgroups of interest.

CHAPTER 10. MULTIPLE CHEMICAL EXPOSURE ANALYSIS

First, to eliminate situations that will not require a cumulative risk assessment, consider the comparative potency of multiple chemicals and whether they

- share the same mechanism of toxicity
- share common biological and/or molecular events
- cause toxicity by acute or chronic exposures

In addition, evaluate

- whether there is exposure to multiple chemicals
- the timing of exposures to multiple chemicals
- routes of exposure
- the spatial scale of exposure to multiple chemicals

The method used to estimate dietary exposure to multiple chemicals needs to adjust the detected residue levels of each of the chemicals considered, by "relative toxicity factors" that reflect the toxicity levels of these chemicals relative to a "standard" chemical. A total adjusted residue then may be derived for each sample by summing the adjusted residue values corresponding to that sample. An exposure assessment is then conducted using these total adjusted residues. The approach is based on the concepts proposed by the National Academy of Sciences (NAS) for the assessment of joint exposure to organophosphate pesticides, and is similar to that followed by the EPA in the case of dioxin-like compounds. DEEM™ does not specify the procedure for establishing the relative potency, but once the user has determined the relative potency, DEEM™ will adjust the residues accordingly.

Based on our experience in conducting cumulative exposures using DEEM™, there are several factors that must be considered in order to estimate reliably the probability of effects from exposure to multiple chemicals. Some of these include:

- Conduct a realistic treatment of the samples with non-detectable residues to reflect actual pesticide usage practices, including the timing of the pesticide applications, and the potential usage of multiple pesticides on the same crop. A probabilistic approach that incorporates information about usage practices is recommended.

- Conduct a realistic treatment of the samples with non-detectable residues to reflect the potential distribution of residue levels below the detection limit. A Monte Carlo approach that incorporates information about the potential association between the detected levels of the various chemicals is recommended.

- Determine consistent procedures for addressing situations where one or more relevant compounds were not estimated or where there is a correlation between the presence of one compound and that of another.

- Develop methodology to permit modeling that will include the differences in time for recovery from potential toxic effects and to account for timing for potential exposure to the population.

- Develop a method for expressing toxicity that is not significantly affected by the experimental doses that were selected for the toxicological testing.

- Identify a common mechanism of action and use that to determine the toxicity, especially in situations where experimental data show that there are multiple mechanisms of action. For example, in the case of organophosphates, some of the chemicals inhibit RBC cholinesterase at higher doses than they inhibit brain cholinesterase, while the reverse is true for others.

- Consider using the dose response patterns in deriving the relative toxicity factors.

The cumulative exposure assessment should be as realistic as the data permit or as the intended application requires. The analysis should identify major source contributions and, if possible, identify the impact of different assumptions. Generally, this will be accomplished by sensitivity analyses. The cumulative exposure will be determined for each individual in a target population (or more often, for a representative sample drawn from the population). In computing this exposure, it is essential that correlations and linkages in individual datasets be maintained.

The specific methodology should allow the best use of the available data, including the physico-chemical and biological information, use/usage, and source information. The exposure assessment methodology will be defined by the toxicity profile of the group of chemicals to be evaluated. The toxicity profile will determine the appropriate time frame, the need to reflect differences in potency of compounds within the group and framework to use to account for correlations in the sources of exposure.

The major problem in moving from single chemical exposure assessment (aggregate) to multiple chemical (cumulative) exposure is that of covariance in the individual datasets. Any cumulative assessment must incorporate methods to ensure that covariance/linkage of residue levels is maintained. In principle, a cumulative assessment could be derived from combinations of aggregate exposure. In practice, the ability to accurately incorporate covariance/linkages will usually require that the cumulative assessments be conducted independently.

Cumulative exposures may be estimated by either deterministic or probabilistic methodologies, or by a combination of both techniques. Ideally, any method used should incorporate those parameters most affecting potential exposures. Not only do personal characteristics, such as body weight, breathing rates and activity patterns vary between individuals, but many types of exposure will occur as episodic events at variable intervals of time.

In conclusion, cumulative exposure must be simultaneously temporally, spatially, and demographically specific. The cumulative intake must refer to dietary, drinking water, residential and other relevant intakes that are for the same individual at the same time and place. The time periods modeled in the cumulative exposure assessment should be equivalent to the time periods of exposure judged to be relevant for the toxicological endpoint that will be used to evaluate the significance of estimated exposures.

APPENDIX A

LISTING OF FOODS, FOOD FORMS, AND CROP GROUPS

APPENDIX A

LISTING OF FOODS, FOOD FORMS, AND CROP GROUPS

Food Code	Crop Grp	Food Name \Food Form	Adjust Factor	CSFII 89-92	CSFII 94-96
1	13A	Blackberries	1.00		
		11 Uncooked		X	X
		13 Baked		X	X
		14 Boiled		X	X
		31 Canned: NFS		X	X
		34 Canned: Boiled		X	X
		41 Frozen: NFS		X	X
2	13A	Boysenberries	1.00		
		31 Canned: NFS		X	X
		34 Canned: Boiled		X	X
		41 Frozen: NFS		X	X
3	13A	Dewberries	1.00		
4	13A	Loganberries	1.00		
5	13A	Raspberries	1.00		
		11 Uncooked		X	X
		13 Baked		X	X
		14 Boiled		X	X
		31 Canned: NFS		X	X
		34 Canned: Boiled			X
		41 Frozen: NFS		X	X
6	13A	Youngberries	1.00		
7	13B	Blueberries	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
		41 Frozen: NFS		X	X
8	O	Cranberries	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		18 Dried		X	X
		31 Canned: NFS		X	X
		42 Frozen: Cooked		X	X
9	O	Cranberries-juice	1.10		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		31 Canned: NFS		X	X
10	13B	Currants	1.00		
		11 Uncooked		X	X
11	13B	Elderberries	1.00		
12	13B	Gooseberries	1.00		
13	O	Grapes	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		31 Canned: NFS		X	X

APPENDIX A (CONT'D)

Food Code	Crop Grp	Food Name \Food Form	Adjust Factor	CSFII 89-92	CSFII 94-96
		41 Frozen: NFS		X	X
14	O	Grapes-raisins	4.30		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		18 Dried		X	X
		42 Frozen: Cooked		X	X
15	O	Grapes-juice	1.20		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		14 Boiled		X	X
		31 Canned: NFS		X	X
		34 Canned: Boiled		X	X
		41 Frozen: NFS		X	
16	13B	Huckleberries	1.00		
17	O	Strawberries	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		31 Canned: NFS		X	X
		34 Canned: Boiled		X	X
		41 Frozen: NFS		X	X
18	O	Juneberry	1.00		
19	O	Mulberries	1.00		
		11 Uncooked		X	X
20	10	Citrus citron	1.00		
		13 Baked		X	X
		14 Boiled		X	X
22	10	Grapefruit-peeled fruit	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	
		31 Canned: NFS		X	X
23	10	Grapefruit-juice	2.10		
		11 Uncooked		X	X
		31 Canned: NFS		X	X
24	10	Kumquats	1.00		
26	10	Lemons-peeled fruit	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		31 Canned: NFS		X	X
27	10	Lemons-peel	1.00		
		11 Uncooked		X	X
		13 Baked		X	X
		14 Boiled		X	X
		31 Canned: NFS		X	
		34 Canned: Boiled		X	X
		41 Frozen: NFS		X	X
28	10	Lemons-juice	2.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X

APPENDIX A (CONT'D)

Food Code	Crop Grp	Food Name \Food Form	Adjust Factor	CSFII 89-92	CSFII 94-96
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		34 Canned: Boiled		X	X
		41 Frozen: NFS		X	X
		42 Frozen: Cooked		X	X
30	10	Limes-peeled fruit	1.00		
		11 Uncooked		X	X
31	10	Limes-peel	1.00		
		13 Baked		X	X
		14 Boiled		X	X
32	10	Limes-juice	2.00		
		11 Uncooked		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		34 Canned: Boiled		X	X
		41 Frozen: NFS		X	X
33	10	Oranges-juice-concentrate	6.70		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	
		14 Boiled		X	X
		31 Canned: NFS		X	X
		41 Frozen: NFS		X	X
		42 Frozen: Cooked		X	X
34	10	Oranges-peeled fruit	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		31 Canned: NFS		X	X
35	10	Oranges-peel	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		31 Canned: NFS		X	X
		41 Frozen: NFS		X	X
36	10	Oranges-juice	1.80		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		31 Canned: NFS		X	X
		41 Frozen: NFS		X	X
37	10	Tangelos	1.00		
38	10	Tangerines	1.00		
		11 Uncooked		X	X
		31 Canned: NFS		X	X
		41 Frozen: NFS		X	
39	10	Tangerines-juice	2.30		
		11 Uncooked			X
		31 Canned: NFS		X	X
		41 Frozen: NFS		X	
40	14	Almonds	1.00		
		11 Uncooked		X	X

APPENDIX A (CONT'D)

Food Code	Crop Grp	Food Name \Food Form	Adjust Factor	CSFII 89-92	CSFII 94-96
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		18 Dried		X	X
		41 Frozen: NFS		X	X
41	14	Brazil nuts	1.00		
		11 Uncooked		X	X
		13 Baked		X	X
		14 Boiled		X	X
		16 Pasteurized		X	X
42	14	Cashews	1.00		
		11 Uncooked		X	X
		13 Baked		X	X
		14 Boiled		X	X
43	14	Chestnuts	1.00		
		12 Cooked: NFS		X	
		13 Baked			X
44	14	Filberts (hazelnuts)	1.00		
		11 Uncooked		X	X
		13 Baked		X	X
		14 Boiled		X	X
45	14	Hickory nuts	1.00		
		11 Uncooked		X	
46	14	Macadamia nuts (bush nuts)	1.00		
		13 Baked		X	X
47	14	Pecans	1.00		
		11 Uncooked		X	X
		13 Baked		X	X
		14 Boiled		X	X
48	14	Walnuts	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
49	14	Butter nuts	1.00		
50	O	Pistachio nuts	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
51	14	Beechnuts	1.00		
52	11	Apples	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		18 Dried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		33 Canned: Baked		X	X
		34 Canned: Boiled		X	X
		42 Frozen: Cooked		X	X

APPENDIX A (CONT'D)

Food Code	Crop Grp	Food Name \Food Form	Adjust Factor	CSFII 89-92	CSFII 94-96
53	11	Apples-dried	8.00		
		13 Baked		X	X
		14 Boiled		X	X
		18 Dried		X	X
		42 Frozen: Cooked		X	
54	11	Apples-juice/cider	1.30		
		11 Uncooked		X	X
		12 Cooked: NFS			X
		14 Boiled		X	X
		31 Canned: NFS		X	X
		41 Frozen: NFS		X	
55	11	Crabapples	1.00		
		31 Canned: NFS			X
56	11	Pears	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	
		14 Boiled		X	X
		31 Canned: NFS		X	X
57	11	Pears-dried	6.25		
		13 Baked		X	X
		14 Boiled		X	
		18 Dried		X	X
58	11	Quinces	1.00		
59	12	Apricots	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		14 Boiled		X	X
		31 Canned: NFS		X	X
		34 Canned: Boiled		X	X
60	12	Apricots-dried	6.00		
		13 Baked		X	X
		14 Boiled		X	X
		18 Dried		X	X
61	12	Cherries	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		31 Canned: NFS		X	X
		33 Canned: Baked		X	X
		41 Frozen: NFS		X	X
62	12	Cherries-dried	4.00		
63	12	Cherries-juice	1.50		
		13 Baked		X	
		14 Boiled		X	X
		31 Canned: NFS		X	X
		41 Frozen: NFS		X	
64	12	Nectarines	1.00		
		11 Uncooked		X	X
65	12	Peaches	1.00		
		11 Uncooked		X	X

APPENDIX A (CONT'D)

Food Code	Crop Grp	Food Name \Food Form	Adjust Factor	CSFII 89-92	CSFII 94-96
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		31 Canned: NFS		X	X
		41 Frozen: NFS		X	X
66	12	Peaches-dried	7.00		
		14 Boiled		X	
		18 Dried		X	X
67	12	Plums (damsons)	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		31 Canned: NFS		X	X
		42 Frozen: Cooked		X	X
		51 Cured: NFS (smoked/pickled/saltd)		X	
68	12	Plums-prunes (dried)	5.00		
		13 Baked		X	X
		14 Boiled		X	X
		18 Dried		X	X
		31 Canned: NFS		X	X
69	12	Plums/prune-juice	1.40		
		11 Uncooked		X	X
		31 Canned: NFS		X	X
70	O	Avocados	1.00		
		11 Uncooked		X	X
72	O	Bananas	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
73	O	Bananas-dried	3.90		
		13 Baked		X	X
		15 Fried		X	X
		18 Dried		X	X
		32 Canned: Cooked			X
74	O	Coconut	1.00		
		11 Uncooked		X	X
		13 Baked		X	X
		14 Boiled		X	X
75	O	Coconut-dried (copra)	2.10		
		12 Cooked: NFS			X
		13 Baked		X	X
		14 Boiled		X	X
		18 Dried		X	X
76	O	Coconut-water	1.00		
		11 Uncooked		X	
		14 Boiled		X	X
77	O	Dates	1.00		
		13 Baked		X	X
		14 Boiled		X	X

APPENDIX A (CONT'D)

Food Code	Crop Grp	Food Name \Food Form	Adjust Factor	CSFII 89-92	CSFII 94-96
		18 Dried		X	X
78	O	Figs	1.00		
		11 Uncooked		X	X
		13 Baked		X	X
79	O	Guava	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		31 Canned: NFS		X	X
80	O	Mangoes	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		31 Canned: NFS		X	X
81	11	Loquats	1.00		
82	O	Olives	1.00		
		60 Canned: Cured		X	X
84	O	Papayas-pulp	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
85	O	Papayas-dried	1.80		
		18 Dried		X	
86	O	Papayas-juice	1.50		
		11 Uncooked		X	X
87	O	Pawpaws	1.00		
88	O	Persimmons	1.00		
		11 Uncooked		X	X
89	O	Pineapples-peeled fruit	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		31 Canned: NFS		X	X
		33 Canned: Baked		X	X
		41 Frozen: NFS		X	X
90	O	Pineapples-dried	5.00		
		18 Dried		X	X
91	O	Pineapples-juice	1.70		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		31 Canned: NFS		X	X
		42 Frozen: Cooked		X	X
92	O	Passion fruit (granadilla)	1.00		
		31 Canned: NFS		X	X
93	O	Pomegranates	1.00		
		11 Uncooked		X	X
94	O	Plantains-ripe	1.00		
		11 Uncooked		X	X
		14 Boiled		X	X
		15 Fried		X	X
95	O	Lychees (litchi)/fresh	1.00		
96	O	Lychee-dried	1.85		
97	O	Kiwi fruit	1.00		
		11 Uncooked		X	X

APPENDIX A (CONT'D)

Food Code	Crop Grp	Food Name \Food Form	Adjust Factor	CSFII 89-92	CSFII 94-96
		31 Canned: NFS			X
98	O	Acerola	1.00		
99	O	Ginkgo nuts	1.00		
100	O	Maney (mammee apple)	1.00		
		11 Uncooked		X	
101	O	Pitanga (surinam cherry)	1.00		
102	O	Soursop (annona muricata)	1.00		
		11 Uncooked		X	
103	O	Sugar apples (sweetsop)	1.00		
104	O	Bread fruit	1.00		
		14 Boiled			X
105	O	Bread nuts	1.00		
106	O	Carambola (starfruit)	1.00		
		11 Uncooked			X
107	O	Cherimoya	1.00		
108	O	Longan fruit	1.00		
109	O	Genip (spanish lime)	1.00		
110	O	Chocolate-cocoa butter	1.00		
		12 Cooked: NFS		X	X
111	O	Chocolate	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		41 Frozen: NFS		X	X
112	O	Coffee	1.00		
		12 Cooked: NFS		X	X
		14 Boiled		X	X
113	O	Tea	1.00		
		12 Cooked: NFS		X	X
114	1AB	Chicory	1.00		
115	19B	Anise	1.00		
		14 Boiled		X	X
		52 Cured: Cooked(smokd/pickld/saltd)		X	X
116	19A	Basil	1.00		
		13 Baked		X	X
		14 Boiled		X	X
117	19B	Caraway	1.00		
		13 Baked		X	X
118	19B	Cassia	1.00		
119	19B	Cinnamon	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
120	19B	Clove	1.00		
		12 Cooked: NFS		X	X
121	19B	Coriander	1.00		
		12 Cooked: NFS		X	X
122	19B	Cumin	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X

APPENDIX A (CONT'D)

Food Code	Crop Grp	Food Name \Food Form		Adjust Factor	CSFII 89-92	CSFII 94-96	
		14 Boiled			X	X	
		42 Frozen: Cooked			X		52
Cured: Cooked(smokd/pickld/saltd)			X	X			
123	19A	Dill		1.00			
		13 Baked				X	
		14 Boiled			X	X	
124	1CD	Ginger		1.00			
		11 Uncooked			X	X	
		12 Cooked: NFS			X	X	
		13 Baked			X	X	
		14 Boiled			X	X	
125	O	Hops		1.00			
		99 Alcohol/Fermented/Distilled			X	X	
126	1AB	Horseradish		1.00			
		12 Cooked: NFS			X	X	
		14 Boiled			X	X	
		34 Canned: Boiled			X	X	
		51 Cured: NFS (smoked/pickled/saltd)			X	X	
127	19A	Rosemary		1.00			
		12 Cooked: NFS			X	X	
128	19A	Marjoram		1.00			
		12 Cooked: NFS			X	X	
		18 Dried			X		
129	19A	Oregano		1.00			
		11 Uncooked			X	X	
		12 Cooked: NFS			X	X	
		42 Frozen: Cooked			X		
130	19B	Mustard seed		1.00			
		11 Uncooked			X	X	
		12 Cooked: NFS			X	X	
		42 Frozen: Cooked			X		
131	19B	Nutmeg		1.00			
		12 Cooked: NFS			X	X	
132	19B	Mace		1.00			
		13 Baked			X	X	
133	19A	Sage		1.00			
		12 Cooked: NFS			X	X	
134	19A	Savory		1.00			
135	19A	Bay		1.00			
		12 Cooked: NFS			X	X	
136	19A	Thyme		1.00			
		12 Cooked: NFS			X	X	
137	1CD	Turmeric		1.00			
		12 Cooked: NFS			X	X	
138	19B	Allspice		1.00			
		12 Cooked: NFS			X	X	
139	8	Paprika		1.00			
		12 Cooked: NFS			X	X	
140	19B	Poppy		1.00			
		12 Cooked: NFS			X	X	
141	9A	Melons-cantaloupes-juice		1.00			
142	9A	Melons-cantaloupes-pulp		1.00			

APPENDIX A (CONT'D)

Food Code	Crop Grp	Food Name \Food Form	Adjust Factor	CSFII 89-92	CSFII 94-96
		11 Uncooked		X	X
143	9A	Casabas	1.00		
		11 Uncooked		X	X
144	9A	Crenshaws	1.00		
145	9A	Melons-honeydew	1.00		
		11 Uncooked		X	X
146	9A	Melons-persian	1.00		
147	9A	Watermelon	1.00		
		11 Uncooked		X	X
148	9B	Cucumbers	1.00		
		11 Uncooked		X	X
		34 Canned: Boiled		X	X
		60 Canned: Cured		X	X
149	9B	Pumpkin	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	
		33 Canned: Baked		X	X
		34 Canned: Boiled		X	X
150	9B	Squash-summer	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		34 Canned: Boiled		X	X
		42 Frozen: Cooked		X	X
		51 Cured: NFS (smoked/pickled/saltd)		X	
151	9B	Squash-winter	1.00		
		11 Uncooked		X	
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
152	9B	Bitter melon	1.00		
		12 Cooked: NFS		X	X
153	O	Towelgourd	1.00		
154	8	Eggplant	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
155	8	Peppers-sweet(garden)	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		34 Canned: Boiled		X	X
		42 Frozen: Cooked		X	X
		51 Cured: NFS (smoked/pickled/saltd)		X	X

APPENDIX A (CONT'D)

Food Code	Crop Grp	Food Name \Food Form	Adjust Factor	CSFII 89-92	CSFII 94-96
156	8	Peppers-chilli incl jalapeno	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		33 Canned: Baked		X	X
		34 Canned: Boiled		X	X
		42 Frozen: Cooked		X	X
		51 Cured: NFS (smoked/pickled/saltd)		X	X
		52 Cured: Cooked(smokd/pickld/saltd)		X	X
		60 Canned: Cured		X	X
157	8	Peppers-other	1.00		
		11 Uncooked			X
158	8	Pimientos	1.00		
		12 Cooked: NFS		X	X
		14 Boiled		X	
		31 Canned: NFS		X	X
		60 Canned: Cured		X	X
159	8	Tomatoes-whole	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		33 Canned: Baked		X	X
		34 Canned: Boiled		X	X
		42 Frozen: Cooked		X	X
160	8	Tomatoes-juice	1.50		
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		34 Canned: Boiled		X	X
		42 Frozen: Cooked			X
161	8	Tomatoes-puree	3.30		
		12 Cooked: NFS		X	X
		14 Boiled		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		33 Canned: Baked		X	X
		34 Canned: Boiled		X	X
		42 Frozen: Cooked		X	X
162	8	Tomatoes-paste	5.40		
		14 Boiled		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		33 Canned: Baked		X	X
		34 Canned: Boiled		X	X
		42 Frozen: Cooked		X	X

APPENDIX A (CONT'D)

Food Code	Crop Grp	Food Name \Food Form	Adjust Factor	CSFII 89-92	CSFII 94-96
163	8	Tomatoes-catsup	2.50		
		34 Canned: Boiled		X	X
164	8	Groundcherries	1.00		
165	2	Beets-garden-tops(greens)	1.00		
		11 Uncooked			X
		14 Boiled		X	X
166	4B	Celery	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		34 Canned: Boiled		X	X
		42 Frozen: Cooked		X	X
167	4A	Chicory(french/belgian endive)	1.00		
		11 Uncooked		X	X
168	5A	Broccoli	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		32 Canned: Cooked		X	X
		42 Frozen: Cooked		X	X
		44 Frozen: Boiled		X	X
169	5A	Brussels sprouts	1.00		
		14 Boiled		X	X
		42 Frozen: Cooked			X
170	5A	Cabbage-green and red	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		51 Cured: NFS (smoked/pickled/saltd)		X	X
171	5A	Cauliflower	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		14 Boiled		X	X
		15 Fried		X	X
		42 Frozen: Cooked		X	X
172	5B	Collards	1.00		
		14 Boiled		X	X
		32 Canned: Cooked			X
		42 Frozen: Cooked			X
174	5B	Kale	1.00		
		12 Cooked: NFS			X
		14 Boiled		X	X

APPENDIX A (CONT'D)

Food Code	Crop Grp	Food Name \Food Form	Adjust Factor	CSFII 89-92	CSFII 94-96
		32 Canned: Cooked			X
175	5A	Kohlrabi	1.00		
		14 Boiled		X	
176	4A	Lettuce-leafy varieties	1.00		
		11 Uncooked		X	X
177	4A	Dandelion-greens	1.00		
		11 Uncooked		X	X
178	4A	Endive-curley and escarole	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
179	19B	Fennel	1.00		
		12 Cooked: NFS		X	X
180	4A	Cress-garden/field	1.00		
		11 Uncooked		X	
		14 Boiled		X	
181	O	Artichokes-globe	1.00		
		14 Boiled		X	X
182	4A	Lettuce-unspecified	1.00		
		31 Canned: NFS		X	X
183	5B	Mustard greens	1.00		
		14 Boiled		X	X
184	4A	Parsley	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	
		34 Canned: Boiled		X	X
185	4B	Rhubarb	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	
		43 Frozen: Baked		X	X
186	4A	Spinach	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		14 Boiled		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		34 Canned: Boiled			X
		42 Frozen: Cooked		X	X
		44 Frozen: Boiled			X
187	4A	Swiss chard	1.00		
		11 Uncooked		X	
		14 Boiled		X	X
188	2	Turnips-tops	1.00		
		14 Boiled		X	X
		32 Canned: Cooked			X
		44 Frozen: Boiled			X
189	O	Watercress	1.00		
		11 Uncooked		X	X

APPENDIX A (CONT'D)

Food Code	Crop Grp	Food Name \Food Form	Adjust Factor	CSFII 89-92	CSFII 94-96
		14 Boiled		X	
		31 Canned: NFS		X	X
190	2	Taro-greens	1.00		
		14 Boiled			X
191	4A	Cress-upland	1.00		
192	4A	Lettuce-head varieties	1.00		
		11 Uncooked		X	X
193	O	Lambsquarter	1.00		
		12 Cooked: NFS			X
194	O	Cactus pads (nopal)	1.00		
195	O	Grapes-leaves	1.00		
		14 Boiled		X	X
196	O	Oriental vegetables/leafy	1.00		
197	1AB	Beets-garden-roots	1.00		
		11 Uncooked		X	X
		14 Boiled		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		51 Cured: NFS (smoked/pickled/saltd)		X	X
198	1AB	Carrots	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		34 Canned: Boiled		X	X
		42 Frozen: Cooked		X	X
		44 Frozen: Boiled		X	X
199	1AB	Celeriac	1.00		
200	19A	Chives	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		18 Dried		X	
201	1CD	Taro-root	1.00		
		12 Cooked: NFS		X	X
		14 Boiled		X	X
202	3	Garlic	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		33 Canned: Baked		X	X
		34 Canned: Boiled		X	X
		42 Frozen: Cooked		X	X
		51 Cured: NFS (smoked/pickled/saltd)		X	X
		52 Cured: Cooked(smokd/pickld/saltd)		X	X

APPENDIX A (CONT'D)

Food Code	Crop Grp	Food Name \Food Form	Adjust Factor	CSFII 89-92	CSFII 94-96
203	1CD	Artichokes-jerusalem	1.00		
		11 Uncooked			X
204	3	Leeks	1.00		
		11 Uncooked			X
		12 Cooked: NFS		X	X
205	3	Onions-dry-bulb (cipollini)	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		34 Canned: Boiled		X	X
		42 Frozen: Cooked		X	X
		43 Frozen: Baked			X
		44 Frozen: Boiled		X	X
		60 Canned: Cured		X	X
206	3	Onions-dehydrated or dried	9.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		34 Canned: Boiled		X	X
		42 Frozen: Cooked		X	X
207	1C	Potatoes/white-whole	1.00		
		11 Uncooked		X	
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
208	1C	Potatoes/white-unspecified	1.00		
		31 Canned: NFS			X
209	1C	Potatoes/white-peeled	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		32 Canned: Cooked		X	X
		34 Canned: Boiled		X	X
		42 Frozen: Cooked		X	X
		43 Frozen: Baked		X	X
		45 Frozen: Fried		X	X
210	1C	Potatoes/white-dry	6.50		
		12 Cooked: NFS		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
		34 Canned: Boiled		X	X

APPENDIX A (CONT'D)

Food Code	Crop Grp	Food Name \Food Form	Adjust Factor	CSFII 89-92	CSFII 94-96
		42 Frozen: Cooked		X	X
211	1C	Potatoes/white-peel only	1.00		
		13 Baked		X	X
		15 Fried		X	X
212	1AB	Radishes-roots	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
213	2	Radishes-tops	1.00		
214	1AB	Rutabagas-roots	1.00		
215	2	Rutabagas-tops	1.00		
		12 Cooked: NFS		X	X
216	1AB	Salsify(oyster plant)	1.00		
217	3	Shallots	1.00		
218	1CD	Sweet potatoes (incl yams)	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		32 Canned: Cooked		X	X
		34 Canned: Boiled		X	
219	1AB	Turnips-roots	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		14 Boiled		X	X
220	1AB	Parsnips	1.00		
		14 Boiled		X	X
221	1CD	Yambean tuber (jicama)	1.00		
		11 Uncooked		X	X
222	1CD	Cassava (yuca blanca)	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
		41 Frozen: NFS		X	X
224	1CD	Yautia (tannier)	1.00		
225	1AB	Parsley roots	1.00		
226	O	Water chestnuts	1.00		
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		34 Canned: Boiled		X	X
		42 Frozen: Cooked		X	X
227	6C	Beans-dry-great northern	1.00		
		32 Canned: Cooked			X
228	6C	Beans-dry-kidney	1.00		
		12 Cooked: NFS			X
		13 Baked		X	X
		14 Boiled		X	X
		32 Canned: Cooked		X	X
		34 Canned: Boiled		X	X

APPENDIX A (CONT'D)

Food Code	Crop Grp	Food Name \Food Form	Adjust Factor	CSFII 89-92	CSFII 94-96
		42 Frozen: Cooked		X	X
229	6C	Beans-dry-lima	1.00		
		14 Boiled		X	X
		32 Canned: Cooked		X	X
230	6C	Beans-dry-navy (pea)	1.00		
		32 Canned: Cooked		X	
		34 Canned: Boiled		X	X
231	6C	Beans-dry-other	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		34 Canned: Boiled		X	X
232	6C	Beans-dry-pinto	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		32 Canned: Cooked		X	X
		42 Frozen: Cooked		X	X
233	6B	Beans-succulent-lima	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		14 Boiled		X	X
		32 Canned: Cooked		X	X
		42 Frozen: Cooked		X	X
		44 Frozen: Boiled		X	X
234	6A	Beans-succulent-green	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		14 Boiled		X	X
		31 Canned: NFS			X
		32 Canned: Cooked		X	X
		34 Canned: Boiled		X	X
		42 Frozen: Cooked		X	X
		44 Frozen: Boiled		X	X
		51 Cured: NFS (smoked/pickled/saltd)		X	
235	6A	Beans-succulent-other	1.00		
		34 Canned: Boiled		X	X
236	6A	Beans-succulent-yellow/wax	1.00		
		14 Boiled		X	X
		32 Canned: Cooked		X	X
		42 Frozen: Cooked			X
237	15	Corn/pop	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
238	15	Corn/sweet	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		32 Canned: Cooked		X	X

APPENDIX A (CONT'D)

Food Code	Crop Grp	Food Name \Food Form	Adjust Factor	CSFII 89-92	CSFII 94-96
		34 Canned: Boiled		X	X
		35 Canned: Fried		X	X
		42 Frozen: Cooked		X	X
240	6C	Peas (garden)-dry	1.00		
		12 Cooked: NFS		X	X
		14 Boiled		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		34 Canned: Boiled		X	X
241	6AB	Peas (garden)-green	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		34 Canned: Boiled		X	X
		42 Frozen: Cooked		X	X
		44 Frozen: Boiled		X	X
		45 Frozen: Fried		X	X
243	6C	Lentils	1.00		
		14 Boiled		X	X
244	6C	Mung beans (sprouts)	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		14 Boiled		X	X
		15 Fried		X	X
245	O	Okra	1.00		
		12 Cooked: NFS		X	X
		14 Boiled		X	X
		15 Fried		X	X
		32 Canned: Cooked		X	X
		42 Frozen: Cooked			X
		44 Frozen: Boiled		X	X
247	O	Carob	1.00		
		13 Baked		X	X
248	O	Alfalfa sprouts	1.00		
		11 Uncooked		X	X
249	6C	Beans-dry-broadbeans	1.00		
		14 Boiled		X	X
250	6B	Beans-succulent-broadbeans	1.00		
251	6C	Beans-dry-pigeon beans	1.00		
252	O	Sesame seeds	1.00		
		11 Uncooked		X	X
		13 Baked		X	X
		14 Boiled		X	X
		42 Frozen: Cooked		X	
253	6	Beans-unspecified	1.00		
254	O	Pinenuts	1.00		
		11 Uncooked		X	X
		14 Boiled		X	X

APPENDIX A (CONT'D)

Food Code	Crop Grp	Food Name \Food Form	Adjust Factor	CSFII 89-92	CSFII 94-96
255	6A	Soybeans-sprouted seeds	0.33		
		14 Boiled		X	X
256	6C	Beans-dry-hyacinth	1.00		
257	6	Beans-succulent-hyacinth	1.00		
258	6C	Beans-dry-blackeye peas/cowpea	1.00		
		14 Boiled		X	X
259	6C	Beans-dry-garbanzo/chick pea	1.00		
		12 Cooked: NFS			X
		14 Boiled		X	X
		15 Fried		X	
		32 Canned: Cooked		X	X
260	O	Asparagus	1.00		
		11 Uncooked		X	X
		14 Boiled		X	X
		32 Canned: Cooked		X	X
		42 Frozen: Cooked			X
261	O	Mushrooms	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		33 Canned: Baked		X	X
		34 Canned: Boiled		X	X
		42 Frozen: Cooked		X	X
262	3	Onions-green	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
263	O	Poke greens	1.00		
		14 Boiled		X	X
264	O	Bamboo shoots	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		14 Boiled		X	X
265	15	Barley	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	
		32 Canned: Cooked		X	X
		34 Canned: Boiled		X	X
		99 Alcohol/Fermented/Distilled		X	X

APPENDIX A (CONT'D)

Food Code	Crop Grp	Food Name \Food Form	Adjust Factor	CSFII 89-92	CSFII 94-96
266	15	Corn grain-endosperm	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		33 Canned: Baked		X	X
		34 Canned: Boiled		X	X
		41 Frozen: NFS		X	X
		42 Frozen: Cooked		X	X
		43 Frozen: Baked		X	X
		45 Frozen: Fried		X	X
		99 Alcohol/Fermented/Distilled		X	X
267	15	Corn grain-bran	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
268	15	Corn grain/sugar/hfcs	1.50		
		98 Refined		X	X
269	15	Oats	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
270	15	Rice-rough (brown)	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		99 Alcohol/Fermented/Distilled		X	X
271	15	Rice-milled (white)	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		34 Canned: Boiled		X	X
		42 Frozen: Cooked		X	X
		99 Alcohol/Fermented/Distilled		X	X
272	15	Rye-rough	1.00		
		12 Cooked: NFS		X	
		13 Baked		X	X
273	15	Rye-germ	1.00		
		13 Baked			X
274	15	Rye-flour	1.00		
		13 Baked		X	X

APPENDIX A (CONT'D)

Food Code	Crop Grp	Food Name \Food Form	Adjust Factor	CSFII 89-92	CSFII 94-96
275	15	Sorghum (including milo)	1.00		
		14 Boiled			X
276	15	Wheat-rough	1.00		
		11 Uncooked		X	
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
277	15	Wheat-germ	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
278	15	Wheat-bran	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
279	15	Wheat-flour	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		33 Canned: Baked		X	X
		34 Canned: Boiled		X	X
		41 Frozen: NFS		X	X
		42 Frozen: Cooked		X	X
		43 Frozen: Baked		X	X
		45 Frozen: Fried		X	X
		52 Cured: Cooked(smokd/pickld/saltd)		X	X
280	15	Millet	1.00		
		13 Baked		X	X
281	O	Honey	1.00		
		11 Uncooked		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		34 Canned: Boiled		X	X
		52 Cured: Cooked(smokd/pickld/saltd)		X	
282	1A	Sugar-beet	1.00		
		98 Refined		X	X
283	O	Sugar-cane	1.00		
		98 Refined		X	X
284	O	Sugar-cane/molasses	1.00		
		13 Baked		X	X
285	O	Maple sugar	1.00		
		14 Boiled		X	X
286	15	Buckwheat	1.00		
		12 Cooked: NFS		X	X
287	6C	Guar beans	1.00		
		13 Baked		X	X
288	O	Castor beans	1.00		

APPENDIX A (CONT'D)

Food Code	Crop Grp	Food Name \Food Form	Adjust Factor	CSFII 89-92	CSFII 94-96
289	15	Corn grain-oil	1.00		
		98 Refined		X	X
290	O	Cottonseed-oil	1.00		
		98 Refined		X	X
291	O	Cottonseed-meal	1.00		
		13 Baked		X	X
292	O	Flax seed	1.00		
		98 Refined		X	X
293	O	Peanuts-oil	1.00		
		98 Refined		X	X
294	O	Safflower-seed	1.00		
295	O	Safflower-oil	1.00		
		98 Refined		X	X
296	O	Sesame-oil	1.00		
		98 Refined		X	X
297	6A	Soybeans-oil	1.00		
		98 Refined		X	X
298	O	Sunflower-oil	1.00		
		98 Refined		X	X
299	O	Coconut-oil	1.00		
		98 Refined		X	X
300	O	Olive oil	1.00		
		98 Refined		X	X
301	O	Canola oil (rape seed oil)	1.00		
		98 Refined		X	X
302	O	Palm oil	1.00		
		98 Refined		X	X
303	6A	Soybean-other	1.00		
304	6A	Soybeans-mature seeds dry	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		41 Frozen: NFS		X	X
305	6A	Soybeans-flour (full fat)	1.00		
		12 Cooked: NFS		X	X
		13 Baked			X
		14 Boiled		X	X
		34 Canned: Boiled		X	X
		42 Frozen: Cooked		X	X
306	6A	Soybeans-flour (low fat)	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
307	6A	Soybeans-flour (defatted)	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
		34 Canned: Boiled		X	X

APPENDIX A (CONT'D)

Food Code	Crop Grp	Food Name \Food Form	Adjust Factor	CSFII 89-92	CSFII 94-96
		42 Frozen: Cooked		X	X
		98 Refined		X	X
308	O	Oriental vegetables/non-leafy	1.00		
309	O	Seeds (misc.)	1.00		
		11 Uncooked			X
		13 Baked		X	X
		14 Boiled		X	X
310	O	Peppermint	1.00		
311	O	Peppermint-oil	1.00		
		14 Boiled		X	X
312	O	Spearmint	1.00		
313	O	Spearmint-oil	1.00		
314	O	Vinegar	1.00		
		99 Alcohol/Fermented/Distilled		X	X
315	O	Grapes-wine and sherry	1.00		
		99 Alcohol/Fermented/Distilled		X	X
316	O	Alcohol-distilled	1.00		
		99 Alcohol/Fermented/Distilled		X	X
317	O	Gelatin	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		41 Frozen: NFS		X	X
318	D	Milk-nonfat solids	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		16 Pasteurized		X	X
		18 Dried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		34 Canned: Boiled		X	X
		41 Frozen: NFS		X	X
		42 Frozen: Cooked		X	X
		43 Frozen: Baked		X	X
		45 Frozen: Fried		X	X
		51 Cured: NFS (smoked/pickled/saltd)		X	X
		52 Cured: Cooked(smokd/pickld/saltd)		X	X
		98 Refined		X	
319	D	Milk-fat solids	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		16 Pasteurized		X	X
		18 Dried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		34 Canned: Boiled		X	X
		41 Frozen: NFS		X	X
		42 Frozen: Cooked		X	X

APPENDIX A (CONT'D)

Food Code	Crop Grp	Food Name \Food Form	Adjust Factor	CSFII 89-92	CSFII 94-96
		45 Frozen: Fried		X	X
		51 Cured: NFS (smoked/pickled/saltd)		X	X
		52 Cured: Cooked(smokd/pickld/saltd)		X	X
320	D	Milk sugar (lactose)	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		16 Pasteurized		X	X
		18 Dried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		34 Canned: Boiled		X	X
		41 Frozen: NFS		X	X
		42 Frozen: Cooked		X	X
		45 Frozen: Fried		X	X
		51 Cured: NFS (smoked/pickled/saltd)		X	X
		52 Cured: Cooked(smokd/pickld/saltd)		X	X
321	M	Beef-meat byproducts	1.00		
		12 Cooked: NFS		X	X
		52 Cured: Cooked(smokd/pickld/saltd)		X	X
322	M	Beef-other organ meats	1.00		
		12 Cooked: NFS		X	X
		14 Boiled		X	X
		52 Cured: Cooked(smokd/pickld/saltd)		X	X
323	M	Beef-dried	1.92		
324	M	Beef-fat w/o bones	1.00		
		11 Uncooked			X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		34 Canned: Boiled		X	X
		42 Frozen: Cooked		X	X
		45 Frozen: Fried		X	X
		51 Cured: NFS (smoked/pickled/saltd)		X	X
		52 Cured: Cooked(smokd/pickld/saltd)		X	X
		59 Cured: Dried (smokd/pickld/saltd)		X	X
325	M	Beef-kidney	1.00		
		12 Cooked: NFS			X
		15 Fried		X	
326	M	Beef-liver	1.00		
		12 Cooked: NFS		X	X
		14 Boiled		X	X
		15 Fried		X	X
327	M	Beef-lean (fat/free) w/o bones	1.00		
		11 Uncooked			X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X

APPENDIX A (CONT'D)

Food Code	Crop Grp	Food Name \Food Form	Adjust Factor	CSFII 89-92	CSFII 94-96
		15 Fried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		33 Canned: Baked		X	X
		34 Canned: Boiled		X	X
		42 Frozen: Cooked		X	X
		51 Cured: NFS (smoked/pickled/saltd)		X	X
		52 Cured: Cooked(smokd/pickld/saltd)		X	X
		59 Cured: Dried (smokd/pickld/saltd)		X	X
328	M	Goat-meat byproducts	1.00		
329	M	Goat-other organ meats	1.00		
330	M	Goat-fat w/o bone	1.00		
		13 Baked		X	X
		14 Boiled		X	X
331	M	Goat-kidney	1.00		
332	M	Goat-liver	1.00		
333	M	Goat-lean (fat/free) w/o bone	1.00		
		13 Baked		X	X
		14 Boiled		X	X
334	M	Horsemeat	1.00		
335	M	Rabbit	1.00		
		12 Cooked: NFS		X	X
336	M	Sheep-meat byproducts	1.00		
337	M	Sheep-other organ meats	1.00		
338	M	Sheep-fat w/o bone	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		31 Canned: NFS		X	X
		52 Cured: Cooked(smokd/pickld/saltd)		X	X
339	M	Sheep-kidney	1.00		
340	M	Sheep-liver	1.00		
341	M	Sheep-lean (fat free) w/o bone	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
342	M	Pork-meat byproducts	1.00		
		12 Cooked: NFS		X	X
		14 Boiled		X	X
		15 Fried		X	X
		52 Cured: Cooked(smokd/pickld/saltd)		X	X
343	M	Pork-other organ meats	1.00		
		12 Cooked: NFS		X	X
		15 Fried		X	X
344	M	Pork-fat w/o bone	1.00		
		11 Uncooked		X	
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X

APPENDIX A (CONT'D)

Food Code	Crop Grp	Food Name \Food Form	Adjust Factor	CSFII 89-92	CSFII 94-96
		32 Canned: Cooked		X	X
		34 Canned: Boiled		X	X
		42 Frozen: Cooked		X	X
		51 Cured: NFS (smoked/pickled/saltd)		X	X
		52 Cured: Cooked(smokd/pickld/saltd)		X	X
		60 Canned: Cured		X	X
345	M	Pork-kidney	1.00		
346	M	Pork-liver	1.00		
		12 Cooked: NFS		X	X
		15 Fried		X	X
347	M	Pork-lean (fat free) w/o bone	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		34 Canned: Boiled		X	X
		42 Frozen: Cooked		X	X
		51 Cured: NFS (smoked/pickled/saltd)		X	X
		52 Cured: Cooked(smokd/pickld/saltd)		X	X
		60 Canned: Cured		X	X
349	F	Fish-shellfish	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		34 Canned: Boiled		X	X
		35 Canned: Fried		X	X
		51 Cured: NFS (smoked/pickled/saltd)		X	X
350	O	Meat-game	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		51 Cured: NFS (smoked/pickled/saltd)		X	
		59 Cured: Dried (smokd/pickld/saltd)		X	X
351	F	Fish-roe/caviar	1.00		
		11 Uncooked		X	X
352	F	Fish-finfish/freshwater	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		51 Cured: NFS (smoked/pickled/saltd)		X	X
353	F	Fish-finfish/saltwater (incl. tuna)	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X

APPENDIX A (CONT'D)

Food Code	Crop Grp	Food Name \Food Form	Adjust Factor	CSFII 89-92	CSFII 94-96
		15 Fried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		33 Canned: Baked		X	X
		34 Canned: Boiled		X	X
		35 Canned: Fried		X	X
		42 Frozen: Cooked		X	X
		51 Cured: NFS (smoked/pickled/saltd)		X	X
		59 Cured: Dried (smokd/pickld/saltd)		X	
354	F	Fish-finfish-saltwater-dried	1.60		
		18 Dried			X
		59 Cured: Dried (smokd/pickld/saltd)		X	
355	P	Turkey-byproducts	1.00		
		12 Cooked: NFS		X	X
		34 Canned: Boiled		X	X
		42 Frozen: Cooked		X	X
		52 Cured: Cooked(smokd/pickld/saltd)		X	X
356	P	Turkey-giblets (liver)	1.00		
		12 Cooked: NFS		X	X
357	P	Turkey--fat w/o bones	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		34 Canned: Boiled		X	X
		42 Frozen: Cooked		X	X
		51 Cured: NFS (smoked/pickled/saltd)		X	X
		52 Cured: Cooked(smokd/pickld/saltd)		X	X
358	P	Turkey- lean/fat free w/o bones	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		34 Canned: Boiled		X	X
		42 Frozen: Cooked		X	X
		51 Cured: NFS (smoked/pickled/saltd)		X	X
		52 Cured: Cooked(smokd/pickld/saltd)		X	X
360	P	Poultry-other-lean (fat free) w/o bone	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
361	P	Poultry-other-giblets(liver)	1.00		
362	P	Poultry-other-fat w/o bones	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
363	P	Eggs-whole	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X

APPENDIX A (CONT'D)

Food Code	Crop Grp	Food Name \Food Form	Adjust Factor	CSFII 89-92	CSFII 94-96
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
		34 Canned: Boiled		X	X
		41 Frozen: NFS		X	X
		42 Frozen: Cooked		X	X
		45 Frozen: Fried		X	X
364	P	Eggs-white only	1.00		
		11 Uncooked			X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		34 Canned: Boiled		X	X
		41 Frozen: NFS		X	X
		42 Frozen: Cooked		X	X
365	P	Eggs-yolk only	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		34 Canned: Boiled		X	X
		41 Frozen: NFS		X	X
366	P	Chicken-byproducts	1.00		
		12 Cooked: NFS		X	X
		34 Canned: Boiled		X	X
367	P	Chicken-giblets(liver)	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	
		15 Fried		X	X
		42 Frozen: Cooked		X	
368	P	Chicken-fat w/o bones	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		34 Canned: Boiled		X	X
		42 Frozen: Cooked		X	X
369	P	Chicken-lean/fat free w/o bones	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X

APPENDIX A (CONT'D)

Food Code	Crop Grp	Food Name \Food Form	Adjust Factor	CSFII 89-92	CSFII 94-96
		34 Canned: Boiled		X	X
		42 Frozen: Cooked		X	X
376	O	Aloe vera-juice	1.00		
		11 Uncooked			X
377	11	Apples-juice-concentrate	3.90		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		31 Canned: NFS		X	X
		41 Frozen: NFS		X	X
378	O	Bananas-juice	1.00		
		11 Uncooked		X	X
		31 Canned: NFS		X	X
379	1A	Sugar-beet-molasses	1.00		
		98 Refined			X
380	13A	Blackberries-juice	1.00		
		11 Uncooked		X	X
		31 Canned: NFS		X	X
381	19B	Pepper/black	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		42 Frozen: Cooked		X	X
		52 Cured: Cooked(smokd/pickld/saltd)		X	X
382	1AB	Burdock	1.00		
		12 Cooked: NFS		X	
383	5B	Cabbage-savoy	1.00		
		12 Cooked: NFS			X
384	4B	Celery juice	1.00		
		31 Canned: NFS		X	X
385	P	Chicken-giblets (excl. liver)	1.00		
		12 Cooked: NFS		X	X
		14 Boiled		X	X
		34 Canned: Boiled		X	X
		42 Frozen: Cooked		X	
386	9B	Christophine	1.00		
387	O	Coconut-milk	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		31 Canned: NFS		X	X
388	15	Corn grain/sugar-molasses	1.50		
		12 Cooked: NFS		X	X
		41 Frozen: NFS		X	X
389	O	Cranberries-juice-concentrate	3.30		
		31 Canned: NFS		X	X
390	O	Fern shoots (fiddleheads)	1.00		
392	O	Grapes-juice-concentrate	3.60		
		12 Cooked: NFS		X	X
		13 Baked		X	X

APPENDIX A (CONT'D)

Food Code	Crop Grp	Food Name \Food Form	Adjust Factor	CSFII 89-92	CSFII 94-96
		14 Boiled		X	X
		31 Canned: NFS		X	X
		41 Frozen: NFS		X	X
393	O	Guava-juice	1.00		
		31 Canned: NFS			X
394	O	Jackfruit	1.00		
395	O	Jobo	1.00		
396	O	Lotus root	1.00		
		14 Boiled		X	X
397	9B	Okra/chinese (luffa)	1.00		
398	D	Milk-based water	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		16 Pasteurized		X	X
		18 Dried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		33 Canned: Baked		X	X
		34 Canned: Boiled		X	X
		41 Frozen: NFS		X	X
		42 Frozen: Cooked		X	X
		43 Frozen: Baked		X	X
		45 Frozen: Fried		X	X
		52 Cured: Cooked(smokd/pickld/saltd)		X	X
399	15	Oats-bran	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	
400	O	Palm hearts	1.00		
		14 Boiled		X	X
401	O	Passion fruit-juice	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		14 Boiled		X	X
		31 Canned: NFS		X	X
402	12	Peaches-juice	1.00		
		11 Uncooked		X	X
		31 Canned: NFS		X	X
403	O	Peanuts-butter	1.89		
		13 Baked		X	X
		14 Boiled		X	X
404	11	Pears-juice	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		31 Canned: NFS		X	X
		33 Canned: Baked		X	X
		41 Frozen: NFS		X	

APPENDIX A (CONT'D)

Food Code	Crop Grp	Food Name \Food Form	Adjust Factor	CSFII 89-92	CSFII 94-96
		42 Frozen: Cooked		X	X
405	6B	Peas-succulent/blackeye/cowpea	1.00		
		12 Cooked: NFS			X
		14 Boiled		X	X
		32 Canned: Cooked			X
		42 Frozen: Cooked			X
406	O	Pineapples-juice-concentrate	6.30		
		12 Cooked: NFS		X	X
		31 Canned: NFS		X	X
		33 Canned: Baked		X	X
		41 Frozen: NFS		X	X
407	1AB	Radishes-japanese (daiken)	1.00		
		12 Cooked: NFS			X
408	15	Rice-bran	1.00		
		11 Uncooked		X	
		12 Cooked: NFS		X	X
		13 Baked		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
409	15	Rice-wild	1.00		
		14 Boiled		X	X
		42 Frozen: Cooked		X	X
410	12	Apricot juice	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS			X
		31 Canned: NFS		X	X
		42 Frozen: Cooked		X	X
411	O	Seaweed	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
412	O	Sequin (portuguese squash)	1.00		
413	6A	Snowpeas	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		14 Boiled		X	X
		15 Fried		X	X
		42 Frozen: Cooked		X	X
414	O	Soursop-juice	1.00		
415	9B	Squash-spaghetti	1.00		
		14 Boiled			X
416	O	Strawberries-juice	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		31 Canned: NFS		X	X
417	O	Sunflower-seeds	1.00		
		11 Uncooked		X	X
		13 Baked		X	X
418	2	Sweet potatos-leaves	1.00		
419	O	Tamarind	1.00		
		11 Uncooked			X

APPENDIX A (CONT'D)

Food Code	Crop Grp	Food Name \Food Form	Adjust Factor	CSFII 89-92	CSFII 94-96
420	10	Tangerines-juice-concentrate	7.35		
422	O	Thistle leaves	1.00		
423	8	Tomatoes-dried	14.30		
		12 Cooked: NFS			X
		15 Fried		X	
424	M	Veal-fat w/o bones	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	
425	M	Veal-lean (fat free) w/o bones	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	
426	M	Veal-kidney	1.00		
		15 Fried			X
427	M	Veal-liver	1.00		
		14 Boiled			X
428	M	Veal-other organ meats	1.00		
429	M	Veal-dried	1.92		
430	M	Veal-meat byproducts	1.00		
431	14	Walnut oil	1.00		
432	O	Water-bottled	1.00		
433	O	Water-tap	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
434	O	Water-commercial processing	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		16 Pasteurized		X	X
		18 Dried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		33 Canned: Baked		X	X
		34 Canned: Boiled		X	X
		35 Canned: Fried		X	X
		41 Frozen: NFS		X	X
		42 Frozen: Cooked		X	X
		43 Frozen: Baked		X	X
		44 Frozen: Boiled			X
		51 Cured: NFS (smoked/pickled/saltd)		X	X
		52 Cured: Cooked(smokd/pickld/saltd)		X	X
		60 Canned: Cured		X	X

APPENDIX A (CONT'D)

Food Code	Crop Grp	Food Name \Food Form	Adjust Factor	CSFII 89-92	CSFII 94-96
		98 Refined		X	X
435	O	Water-non-food based	1.00		
436	9A	Watermelon-juice	1.00		
437	15	Wheat-germ oil	1.00		
		13 Baked		X	X
438	O	Wi-apple	1.00		
439	9B	Wintermelon	1.00		
		14 Boiled			X
440	O	Yeast	1.00		
		12 Cooked: NFS		X	X
		99 Alcohol/Fermented/Distilled		X	X
441	10	Grapefruit-juice-concentrate	8.26		
		41 Frozen: NFS		X	X
442	10	Lemons-juice-concentrate	11.40		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		31 Canned: NFS		X	X
		34 Canned: Boiled		X	X
		41 Frozen: NFS		X	X
443	10	Limes-juice-concentrate	6.00		
		12 Cooked: NFS		X	X
		41 Frozen: NFS		X	X
447	4A	Chervil	1.00		
		14 Boiled		X	X
448	10	Grapefruit peel	1.00		
449	P	Turkey-other organ meats	1.00		
		12 Cooked: NFS		X	X
450	1AB	Ginseng	1.00		
		11 Uncooked			X
451	5A	Broccoli-chinese	1.00		
		14 Boiled		X	X
452	5B	Bok choy	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		14 Boiled		X	X
		42 Frozen: Cooked		X	X
		51 Cured: NFS (smoked/pickled/saltd)		X	X
460	O	Seafood-misc(turtle/frog)	1.00		
		12 Cooked: NFS			X
		14 Boiled		X	X
467	19B	Celery seed	1.00		
		11 Uncooked		X	X
		14 Boiled		X	X
		31 Canned: NFS		X	X
		51 Cured: NFS (smoked/pickled/saltd)		X	X
473	O	Sapodilla	1.00		
480	O	Plantains-green	1.00		
		15 Fried			X
481	O	Plantains-dried	3.90		
482	O	Soybeans-protein isolate	1.00		
		12 Cooked: NFS		X	X

APPENDIX A (CONT'D)

Food Code	Crop Grp	Food Name \Food Form	Adjust Factor	CSFII 89-92	CSFII 94-96
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		33 Canned: Baked		X	X
		34 Canned: Boiled		X	X
		41 Frozen: NFS		X	X
		42 Frozen: Cooked		X	X
		51 Cured: NFS (smoked/pickled/saltd)			X
483	O	Chayote	1.00		
484	O	Radishes-oriental	1.00		
485	O	Leaves (misc)	1.00		
		11 Uncooked		X	
		14 Boiled		X	X
		31 Canned: NFS		X	X
		34 Canned: Boiled		X	X
489	O	Vanilla	1.00		
		99 Alcohol/Fermented/Distilled		X	X
491	O	Arugula	1.00		
		11 Uncooked			X
492	O	Radicchio	1.00		
		11 Uncooked			X
493	O	Tarragon	1.00		
		14 Boiled		X	X
494	O	Saffron	1.00		
		14 Boiled		X	X
495	O	Cilantro	1.00		
		11 Uncooked			X
		12 Cooked: NFS			X
496	O	Nopales	1.00		
		11 Uncooked			X
		14 Boiled		X	X
497	9B	Balsam pear	1.00		
498	4A	Amaranth	1.00		
		13 Baked		X	X
890	O	Miscellaneous/nfs	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		33 Canned: Baked		X	X
		34 Canned: Boiled		X	X
		41 Frozen: NFS		X	X
		42 Frozen: Cooked		X	X
		51 Cured: NFS (smoked/pickled/saltd)		X	X
		52 Cured: Cooked(smokd/pickld/saltd)		X	X
		60 Canned: Cured		X	X

APPENDIX A (CONT'D)

Food Code	Crop Grp	Food Name \Food Form	Adjust Factor	CSFII 89-92	CSFII 94-96
891	O	Jute	1.00		
892	O	Chrysanthemum	1.00		
893	O	Salt	1.00		
		98 Refined		X	X
894	O	Leavening agents	1.00		
		12 Cooked: NFS		X	X
895	O	Psyllium	1.00		
		13 Baked		X	X
896	O	Sweeteners-artificial	1.00		
		12 Cooked: NFS		X	X
897	O	Gums/gels	1.00		
		11 Uncooked		X	X
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		31 Canned: NFS		X	X
		32 Canned: Cooked		X	X
		34 Canned: Boiled		X	X
		41 Frozen: NFS		X	X
		42 Frozen: Cooked		X	X
911	O	Molasses-nfs	1.00		
		98 Refined		X	X
940	O	Peanuts-hulled	1.00		
		12 Cooked: NFS		X	X
		13 Baked		X	X
		14 Boiled		X	X
		15 Fried		X	X
		41 Frozen: NFS		X	X
950	O	Beer	1.00		
		99 Alcohol/Fermented/Distilled		X	X

APPENDIX B

BACKGROUND INFORMATION ON THE CONSUMPTION DATA USED IN DEEM™

APPENDIX B

BACKGROUND INFORMATION ON THE CONSUMPTION DATA USED IN DEEM™

1989 through 1992 Consumption Data

Consumption data used by the DEEM™ software have been generated by USDA food consumption surveys. Weights were developed by USDA to adjust for the differences in the probability of selection, to adjust for non-response and to allow for the combination of the data from the three Continuing Surveys of Food Intake by Individuals (CSFII): 1989-90, 1990-91 and 1991-92.

Regression weights were developed by a group of statisticians at Iowa State University. Fourteen demographic characteristics and month of the interview were used to derive the weights for the individuals in the survey so that the distribution of the weighted sample becomes similar to that of the US population with respect to the demographic characteristics. Weights were derived separately for males age 20 years and older, females age 20 years and older and persons less than 20 years of age.

Meal planner/preparer reported the subject's race/ethnicity.

States in the region:

The consumption data use the U.S. Census classification of four main regions, each of which is subdivided into two or three geographical regions as follows:

1. North East:
   a. Middle Atlantic:
      New Jersey, New York, Pennsylvania
   b. New England:
      Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont
2. Midwest
   a. East North Central:
      Illinois, Indiana, Michigan, Ohio, Wisconsin
   b. West North Central:
      Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota
3. South
   a. East South Central:
      Alabama, Kentucky, Mississippi, Tennessee
   b. South Atlantic:
      Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia

APPENDIX B (CONT'D)

c. West South Central:
Arkansas, Louisiana, Oklahoma, Texas

4. West:
a. Mountain:
Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming
b. Pacific:
California, Oregon, Washington

Listing of the months included in the seasons

a. Spring
April, May, June
b. Summer:
July, August, September
c. Fall
October, November, December
d. Winter
January, February, March

1994 through 1996 Consumption Data

Replicate weights were developed by statisticians at Westat, Inc. Seventeen demographic characteristics and month of the interview were used to derive the weights for the individuals in the survey so that the distribution of the weighted sample becomes similar to that of the US population with respect to the demographic characteristics. Weights were derived separately for males age 20 years and older, females age 20 years and older, children 5 years of age and younger, and persons 6 to 19 years of age.

Meal planner/preparer reported the subject's race/ethnicity.

States in the region:

The consumption data use the US Census classification of four main regions:

1. North East:
New Jersey, New York, Pennsylvania, Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont
2. Midwest
Illinois, Indiana, Michigan, Ohio, Wisconsin
Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota

APPENDIX B (CONT'D)

3. South
   Alabama, Kentucky, Mississippi, Tennessee
   Delaware, District of Columbia, Florida, Georgia,
   Maryland, North Carolina, South Carolina, Virginia,
   West Virginia, Arkansas, Louisiana, Oklahoma, Texas
4. West:
   Arizona, Colorado, Idaho, Montana, Nevada, New Mexico,
   Utah, Wyoming, California, Oregon, Washington

Listing of the months included in the seasons

a. Spring
   April, May, June
b. Summer:
   July, August, September
c. Fall
   October, November, December
d. Winter
   January, February, March

APPENDIX C

FOOD LIST IN RAC CODE ORDER

APPENDIX C

FOOD LIST IN RAC CODE ORDER

RAC Code	Crop Group	Commodity	Adjustment # 1
1	13A	Blackberries	1
2	13A	Boysenberries	1
3	13A	Dewberries	1
4	13A	Loganberries	1
5	13A	Raspberries	1
6	13A	Youngberries	1
7	13B	Blueberries	1
8	O	Cranberries	1
9	O	Cranberries-juice	1.1
10	13B	Currants	1
11	13B	Elderberries	1
12	13B	Gooseberries	1
13	O	Grapes	1
14	O	Grapes-raisins	4.3
15	O	Grapes-juice	1.2
16	13B	Huckleberries	1
17	O	Strawberries	1
18	O	Juneberry	1
19	O	Mulberries	1
20	10	Citrus citron	1
22	10	Grapefruit-peeled fruit	1
23	10	Grapefruit-juice	2.1
24	10	Kumquats	1
26	10	Lemons-peeled fruit	1
27	10	Lemons-peel	1
28	10	Lemons-juice	2
30	10	Limes-peeled fruit	1
31	10	Limes-peel	1
32	10	Limes-juice	2
33	10	Oranges-juice-concentrate	6.7
34	10	Oranges-peeled fruit	1
35	10	Oranges-peel	1
36	10	Oranges-juice	1.8
37	10	Tangelos	1
38	10	Tangerines	1
39	10	Tangerines-juice	2.3
40	14	Almonds	1
41	14	Brazil nuts	1
42	14	Cashews	1
43	14	Chestnuts	1
44	14	Filberts (hazelnuts)	1
45	14	Hickory nuts	1

APPENDIX C (CONT'D)

RAC Code	Crop Group	Commodity	Adjustment # 1
46	14	Macadamia nuts (bush nuts)	1
47	14	Pecans	1
48	14	Walnuts	1
49	14	Butter nuts	1
50	O	Pistachio nuts	1
51	14	Beechnuts	1
52	11	Apples	1
53	11	Apples-dried	8
54	11	Apples-juice/cider	1.3
55	11	Crabapples	1
56	11	Pears	1
57	11	Pears-dried	6.25
58	11	Quinces	1
59	12	Apricots	1
60	12	Apricots-dried	6
61	12	Cherries	1
62	12	Cherries-dried	4
63	12	Cherries-juice	1.5
64	12	Nectarines	1
65	12	Peaches	1
66	12	Peaches-dried	7
67	12	Plums (damsons)	1
68	12	Plums-prunes (dried)	5
69	12	Plums/prune-juice	1.4
70	O	Avocados	1
72	O	Bananas	1
73	O	Bananas-dried	3.9
74	O	Coconut	1
75	O	Coconut-dried (copra)	2.1
76	O	Coconut-water	1
77	O	Dates	1
78	O	Figs	1
79	O	Guava	1
80	O	Mangoes	1
81	11	Loquats	1
82	O	Olives	1
84	O	Papayas-pulp	1
85	O	Papayas-dried	1.8
86	O	Papayas-juice	1.5
87	O	Pawpaws	1

APPENDIX C (CONT'D)

RAC Code	Crop Group	Commodity	Adjustment # 1
88	O	Persimmons	1
89	O	Pineapples-peeled fruit	1
90	O	Pineapples-dried	5
91	O	Pineapples-juice	1.7
92	O	Passion fruit (granadilla)	1
93	O	Pomegranates	1
94	O	Plantains-ripe	1
95	O	Lychees (litchi)/fresh	1
96	O	Lychee-dried	1.85
97	O	Kiwi fruit	1
98	O	Acerola	1
99	O	Ginkgo nuts	1
100	O	Maney (mammee apple)	1
101	O	Pitanga (surinam cherry)	1
102	O	Soursop (annona muricata)	1
103	O	Sugar apples (sweetsop)	1
104	O	Bread fruit	1
105	O	Bread nuts	1
106	O	Carambola (starfruit)	1
107	O	Cherimoya	1
108	O	Longan fruit	1
109	O	Genip (spanish lime)	1
110	O	Chocolate-cocoa butter	1
111	O	Chocolate	1
112	O	Coffee	1
113	O	Tea	1
114	1AB	Chicory	1
115	19B	Anise	1
116	19A	Basil	1
117	19B	Caraway	1
118	19B	Cassia	1
119	19B	Cinnamon	1
120	19B	Clove	1
121	19B	Coriander	1
122	19B	Cumin	1
123	19A	Dill	1
124	1CD	Ginger	1
125	O	Hops	1
126	1AB	Horseradish	1
127	19A	Rosemary	1
128	19A	Marjoram	1

APPENDIX C (CONT'D)

RAC Code	Crop Group	Commodity	Adjustment # 1
129	19A	Oregano	1
130	19B	Mustard seed	1
131	19B	Nutmeg	1
132	19B	Mace	1
133	19A	Sage	1
134	19A	Savory	1
135	19A	Bay	1
136	19A	Thyme	1
137	1CD	Turmeric	1
138	19B	Allspice	1
139	8	Paprika	1
140	19B	Poppy	1
141	9A	Melons-cantaloupes-juice	1
142	9A	Melons-cantaloupes-pulp	1
143	9A	Casabas	1
144	9A	Crenshaws	1
145	9A	Melons-honeydew	1
146	9A	Melons-persian	1
147	9A	Watermelon	1
148	9B	Cucumbers	1
149	9B	Pumpkin	1
150	9B	Squash-summer	1
151	9B	Squash-winter	1
152	9B	Bitter melon	1
153	O	Towelgourd	1
154	8	Eggplant	1
155	8	Peppers-sweet(garden)	1
156	8	Peppers-chilli incl jalapeno	1
157	8	Peppers-other	1
158	8	Pimientos	1
159	8	Tomatoes-whole	1
160	8	Tomatoes-juice	1.5
161	8	Tomatoes-puree	3.3
162	8	Tomatoes-paste	5.4
163	8	Tomatoes-catsup	2.5
164	8	Groundcherries	1
165	2	Beets-garden-tops(greens)	1
166	4B	Celery	1
167	4A	Chicory(french/belgian endive)	1
168	5A	Broccoli	1
169	5A	Brussels sprouts	1

APPENDIX C (CONT'D)

RAC Code	Crop Group	Commodity	Adjustment # 1
170	5A	Cabbage-green and red	1
171	5A	Cauliflower	1
172	5B	Collards	1
174	5B	Kale	1
175	5A	Kohlrabi	1
176	4A	Lettuce-leafy varieties	1
177	4A	Dandelion-greens	1
178	4A	Endive-curley and escarole	1
179	19B	Fennel	1
180	4A	Cress-garden/field	1
181	O	Artichokes-globe	1
182	4A	Lettuce-unspecified	1
183	5B	Mustard greens	1
184	4A	Parsley	1
185	4B	Rhubarb	1
186	4A	Spinach	1
187	4A	Swiss chard	1
188	2	Turnips-tops	1
189	O	Watercress	1
190	2	Taro-greens	1
191	4A	Cress-upland	1
192	4A	Lettuce-head varieties	1
193	O	Lambsquarter	1
194	O	Cactus pads (nopal)	1
195	O	Grapes-leaves	1
196	O	Oriental vegetables/leafy	1
197	1AB	Beets-gargen-roots	1
198	1AB	Carrots	1
199	1AB	Celeriac	1
200	19A	Chives	1
201	1CD	Taro-root	1
202	3	Garlic	1
203	1CD	Artichokes-jerusalem	1
204	3	Leeks	1
205	3	Onions-dry-bulb (cipollini)	1
206	3	Onions-dehydrated or dried	9
207	1C	Potatoes/white-whole	1
208	1C	Potatoes/white-unspecified	1
209	1C	Potatoes/white-peeled	1
210	1C	Potatoes/white-dry	6.5
211	1C	Potatoes/white-peel only	1

APPENDIX C (CONT'D)

RAC Code	Crop Group	Commodity	Adjustment # 1
212	1AB	Radishes-roots	1
213	2	Radishes-tops	1
214	1AB	Rutabagas-roots	1
215	2	Rutabagas-tops	1
216	1AB	Salsify(oyster plant)	1
217	3	Shallots	1
218	1CD	Sweet potatoes (incl yams)	1
219	1AB	Turnips-roots	1
220	1AB	Parsnips	1
221	1CD	Yambean tuber (jicama)	1
222	1CD	Cassava (yuca blanca)	1
224	1CD	Yautia (tannier)	1
225	1AB	Parsley roots	1
226	O	Water chestnuts	1
227	6C	Beans-dry-great northern	1
228	6C	Beans-dry-kidney	1
229	6C	Beans-dry-lima	1
230	6C	Beans-dry-navy (pea)	1
231	6C	Beans-dry-other	1
232	6C	Beans-dry-pinto	1
233	6B	Beans-succulent-lima	1
234	6A	Beans-succulent-green	1
235	6A	Beans-succulent-other	1
236	6A	Beans-succulent-yellow/wax	1
237	15	Corn/pop	1
238	15	Corn/sweet	1
240	6C	Peas (garden)-dry	1
241	6AB	Peas (garden)-green	1
243	6C	Lentils	1
244	6C	Mung beans (sprouts)	1
245	O	Okra	1
247	O	Carob	1
248	O	Alfalfa sprouts	1
249	6C	Beans-dry-broadbeans	1
250	6B	Beans-succulent-broadbeans	1
251	6C	Beans-dry-pigeon beans	1
252	O	Sesame seeds	1
253	6	Beans-unspecified	1
254	O	Pinenuts	1
255	6A	Soybeans-sprouted seeds	0.33
256	6C	Beans-dry-hyacinth	1

APPENDIX C (CONT'D)

RAC Code	Crop Group	Commodity	Adjustment # 1
257	6	Beans-succulent-hyacinth	1
258	6C	Beans-dry-blackeye peas/cowpea	1
259	6C	Beans-dry-garbanzo/chick pea	1
260	O	Asparagus	1
261	O	Mushrooms	1
262	3	Onions-green	1
263	O	Poke greens	1
264	O	Bamboo shoots	1
265	15	Barley	1
266	15	Corn grain-endosperm	1
267	15	Corn grain-bran	1
268	15	Corn grain/sugar/hfcs	1.5
269	15	Oats	1
270	15	Rice-rough (brown)	1
271	15	Rice-milled (white)	1
272	15	Rye-rough	1
273	15	Rye-germ	1
274	15	Rye-flour	1
275	15	Sorghum (including milo)	1
276	15	Wheat-rough	1
277	15	Wheat-germ	1
278	15	Wheat-bran	1
279	15	Wheat-flour	1
280	15	Millet	1
281	O	Honey	1
282	1A	Sugar-beet	1
283	O	Sugar-cane	1
284	O	Sugar-cane/molasses	1
285	O	Maple sugar	1
286	15	Buckwheat	1
287	6C	Guar beans	1
288	O	Castor beans	1
289	15	Corn grain-oil	1
290	O	Cottonseed-oil	1
291	O	Cottonseed-meal	1
292	O	Flax seed	1
293	O	Peanuts-oil	1
294	O	Safflower-seed	1
295	O	Safflower-oil	1
296	O	Sesame-oil	1
297	6A	Soybeans-oil	1

APPENDIX C (CONT'D)

RAC Code	Crop Group	Commodity	Adjustment # 1
298	O	Sunflower-oil	1
299	O	Coconut-oil	1
300	O	Olive oil	1
301	O	Canola oil (rape seed oil)	1
302	O	Palm oil	1
303	6A	Soybean-other	1
304	6A	Soybeans-mature seeds dry	1
305	6A	Soybeans-flour (full fat)	1
306	6A	Soybeans-flour (low fat)	1
307	6A	Soybeans-flour (defatted)	1
308	O	Oriental vegetables/non-leafy	1
309	O	Seeds (misc.)	1
310	O	Peppermint	1
311	O	Peppermint-oil	1
312	O	Spearmint	1
313	O	Spearmint-oil	1
314	O	Vinegar	1
315	O	Grapes-wine and sherry	1
316	O	Alcohol-distilled	1
317	O	Gelatin	1
318	D	Milk-nonfat solids	1
319	D	Milk-fat solids	1
320	D	Milk sugar (lactose)	1
321	M	Beef-meat byproducts	1
322	M	Beef-other organ meats	1
323	M	Beef-dried	1.92
324	M	Beef-fat w/o bones	1
325	M	Beef-kidney	1
326	M	Beef-liver	1
327	M	Beef-lean (fat/free) w/o bones	1
328	M	Goat-meat byproducts	1
329	M	Goat-other organ meats	1
330	M	Goat-fat w/o bone	1
331	M	Goat-kidney	1
332	M	Goat-liver	1
333	M	Goat-lean (fat/free) w/o bone	1
334	M	Horsemeat	1
335	M	Rabbit	1
336	M	Sheep-meat byproducts	1
337	M	Sheep-other organ meats	1
338	M	Sheep-fat w/o bone	1

APPENDIX C (CONT'D)

RAC Code	Crop Group	Commodity	Adjustment # 1
339	M	Sheep-kidney	1
340	M	Sheep-liver	1
341	M	Sheep-lean (fat free) w/o bone	1
342	M	Pork-meat byproducts	1
343	M	Pork-other organ meats	1
344	M	Pork-fat w/o bone	1
345	M	Pork-kidney	1
346	M	Pork-liver	1
347	M	Pork-lean (fat free) w/o bone	1
349	F	Fish-shellfish	1
350	O	Meat-game	1
351	F	Fish-roe/caviar	1
352	F	Fish-finfish/freshwater	1
353	F	Fish-finfish/saltwater (incl.	1
354	F	Fish-finfish-saltwater-dried	1.6
355	P	Turkey-byproducts	1
356	P	Turkey-giblets (liver)	1
357	P	Turkey--fat w/o bones	1
358	P	Turkey- lean/fat free w/o bone	1
360	P	Poultry-other-lean (fat free)	1
361	P	Poultry-other-giblets(liver)	1
362	P	Poultry-other-fat w/o bones	1
363	P	Eggs-whole	1
364	P	Eggs-white only	1
365	P	Eggs-yolk only	1
366	P	Chicken-byproducts	1
367	P	Chicken-giblets(liver)	1
368	P	Chicken-fat w/o bones	1
369	P	Chicken-lean/fat free w/o bone	1
376	O	Aloe vera-juice	1
377	11	Apples-juice-concentrate	3.9
378	O	Bananas-juice	1
379	1A	Sugar-beet-molasses	1
380	13A	Blackberries-juice	1
381	19B	Pepper/black	1
382	1AB	Burdock	1
383	5B	Cabbage-savoy	1
384	4B	Celery juice	1
385	P	Chicken-giblets (excl. liver)	1
386	9B	Christophine	1
387	O	Coconut-milk	1

APPENDIX C (CONT'D)

RAC Code	Crop Group	Commodity	Adjustment # 1
388	15	Corn grain/sugar-molasses	1.5
389	O	Cranberries-juice-concentrate	3.3
390	O	Fern shoots (fiddleheads)	1
392	O	Grapes-juice-concentrate	3.6
393	O	Guava-juice	1
394	O	Jackfruit	1
395	O	Jobo	1
396	O	Lotus root	1
397	9B	Okra/chinese (luffa)	1
398	D	Milk-based water	1
399	15	Oats-bran	1
400	O	Palm hearts	1
401	O	Passion fruit-juice	1
402	12	Peaches-juice	1
403	O	Peanuts-butter	1.89
404	11	Pears-juice	1
405	6B	Peas-succulent/blackeye/cowpea	1
406	O	Pineapples-juice-concentrate	6.3
407	1AB	Radishes-japanese (daiken)	1
408	15	Rice-bran	1
409	15	Rice-wild	1
410	12	Apricot juice	1
411	O	Seaweed	1
412	O	Sequin (portuguese squash)	1
413	6A	Snowpeas	1
414	O	Soursop-juice	1
415	9B	Squash-spaghetti	1
416	O	Strawberries-juice	1
417	O	Sunflower-seeds	1
418	2	Sweet potatos-leaves	1
419	O	Tamarind	1
420	10	Tangerines-juice-concentrate	7.35
422	O	Thistle leaves	1
423	8	Tomatoes-dried	14.3
424	M	Veal-fat w/o bones	1
425	M	Veal-lean (fat free) w/o bones	1
426	M	Veal-kidney	1
427	M	Veal-liver	1
428	M	Veal-other organ meats	1
429	M	Veal-dried	1.92
430	M	Veal-meat byproducts	1

APPENDIX C (CONT'D)

RAC Code	Crop Group	Commodity	Adjustment # 1
431	14	Walnut oil	1
432	O	Water-bottled	1
433	O	Water-tap	1
434	O	Water-commercial processing	1
435	O	Water-non-food based	1
436	9A	Watermelon-juice	1
437	15	Wheat-germ oil	1
438	O	Wi-apple	1
439	9B	Wintermelon	1
440	O	Yeast	1
441	10	Grapefruit-juice-concentrate	8.26
442	10	Lemons-juice-concentrate	11.4
443	10	Limes-juice-concentrate	6
447	4A	Chervil	1
448	10	Grapefruit peel	1
449	P	Turkey-other organ meats	1
450	1AB	Ginseng	1
451	5A	Broccoli-chinese	1
452	5B	Bok choi	1
460	O	Seafood-misc(turtle/frog)	1
467	19B	Celery seed	1
473	O	Sapodilla	1
480	O	Plantains-green	1
481	O	Plantains-dried	3.9
482	O	Soybeans-protein isolate	1
483	O	Chayote	1
484	O	Radishes-oriental	1
485	O	Leaves (misc)	1
489	O	Vanilla	1
491	O	Arugula	1
492	O	Radicchio	1
493	O	Tarragon	1
494	O	Saffron	1
495	O	Cilantro	1
496	O	Nopales	1
497	9B	Balsam pear	1
498	4A	Amaranth	1
890	O	Miscellaneous/nfs	1
891	O	Jute	1
892	O	Chrysanthemum	1
893	O	Salt	1

APPENDIX C (CONT'D)

RAC Code	Crop Group	Commodity	Adjustment # 1
894	O	Leavening agents	1
895	O	Psyllium	1
896	O	Sweeteners-artificial	1
897	O	Gums/gels	1
911	O	Molasses-nfs	1
940	O	Peanuts-hulled	1
950	O	Beer	1

APPENDIX D

FOOD LIST IN ALPHABETICAL ORDER

APPENDIX D

FOOD LIST IN ALPHABETICAL ORDER

RAC Code	Crop Group	Commodity	Adjustment # 1
98	O	Acerola	1
316	O	Alcohol-distilled	1
248	O	Alfalfa sprouts	1
138	19B	Allspice	1
40	14	Almonds	1
376	O	Aloe vera-juice	1
498	4A	Amaranth	1
115	19B	Anise	1
52	11	Apples	1
53	11	Apples-dried	8
54	11	Apples-juice/cider	1.3
377	11	Apples-juice-concentrate	3.9
410	12	Apricot juice	1
59	12	Apricots	1
60	12	Apricots-dried	6
181	O	Artichokes-globe	1
203	1CD	Artichokes-jerusalem	1
491	O	Arugula	1
260	O	Asparagus	1
70	O	Avocados	1
497	9B	Balsam pear	1
264	O	Bamboo shoots	1
72	O	Bananas	1
73	O	Bananas-dried	3.9
378	O	Bananas-juice	1
265	15	Barley	1
116	19A	Basil	1
135	19A	Bay	1
258	6C	Beans-dry-blackeye peas/cowpea	1
249	6C	Beans-dry-broadbeans	1
259	6C	Beans-dry-garbanzo/chick pea	1
227	6C	Beans-dry-great northern	1
256		Beans-dry-hyacinth	1
228	6C	Beans-dry-kidney	1
229	6C	Beans-dry-lima	1
230	6C	Beans-dry-navy (pea)	1
231	6C	Beans-dry-other	1
251	6C	Beans-dry-pigeon beans	1
232	6C	Beans-dry-pinto	1
250	6B	Beans-succulent-broadbeans	1
234	6A	Beans-succulent-green	1
257		Beans-succulent-hyacinth	1
233	6B	Beans-succulent-lima	1
235	6A	Beans-succulent-other	1
236	6A	Beans-succulent-yellow/wax	1

APPENDIX D (CONT'D)

RAC Code	Crop Group	Commodity	Adjustment # 1
253	6	Beans-unspecified	1
51	14	Beechnuts	1
323	M	Beef-dried	1.92
324	M	Beef-fat w/o bones	1
325	M	Beef-kidney	1
327	M	Beef-lean (fat/free) w/o bones	1
326	M	Beef-liver	1
321	M	Beef-meat byproducts	1
322	M	Beef-other organ meats	1
950	O	Beer	1
197	1AB	Beets-gargen-roots	1
165	2	Beets-garden-tops(greens)	1
152	9B	Bitter melon	1
1	13A	Blackberries	1
380	13A	Blackberries-juice	1
7	13B	Blueberries	1
452	5B	Bok choi	1
2	13A	Boysenberries	1
41	14	Brazil nuts	1
104	O	Bread fruit	1
105	O	Bread nuts	1
168	5A	Broccoli	1
451	5A	Broccoli-chinese	1
169	5A	Brussels sprouts	1
286	15	Buckwheat	1
382	1AB	Burdock	1
49	14	Butter nuts	1
170	5A	Cabbage-green and red	1
383	5B	Cabbage-savoy	1
194	O	Cactus pads (nopal)	1
301	O	Canola oil (rape seed oil)	1
106	O	Carambola (starfruit)	1
117	19B	Caraway	1
247	O	Carob	1
198	1AB	Carrots	1
143	9A	Casabas	1
42	14	Cashews	1
222	1CD	Cassava (yuca blanca)	1
118	19B	Cassia	1
288	O	Castor beans	1
171	5A	Cauliflower	1
199	1AB	Celeriac	1
166	4B	Celery	1
384	4B	Celery juice	1
467	19B	Celery seed	1
483	O	Chayote	1
107	O	Cherimoya	1

APPENDIX D (CONT'D)

RAC Code	Crop Group	Commodity	Adjustment # 1
61	12	Cherries	1
62	12	Cherries-dried	4
63	12	Cherries-juice	1.5
447	4A	Chervil	1
43	14	Chestnuts	1
366	P	Chicken-byproducts	1
368	P	Chicken-fat w/o bones	1
367	P	Chicken-giblets(liver)	1
385	P	Chicken-giblets (excl. liver)	1
369	P	Chicken-lean/fat free w/o bone	1
114	1AB	Chicory	1
167	4A	Chicory(french/belgian endive)	1
200	19A	Chives	1
111	O	Chocolate	1
110	O	Chocolate-cocoa butter	1
386	9B	Christophine	1
892	O	Chrysanthemum	1
495	O	Cilantro	1
119	19B	Cinnamon	1
20	10	Citrus citron	1
120	19B	Clove	1
75	O	Coconut-dried (copra)	2.1
387	O	Coconut-milk	1
299	O	Coconut-oil	1
76	O	Coconut-water	1
74	O	Coconut	1
112	O	Coffee	1
172	5B	Collards	1
121	19B	Coriander	1
267	15	Corn grain-bran	1
266	15	Corn grain-endosperm	1
289	15	Corn grain-oil	1
268	15	Corn grain/sugar/hfcs	1.5
388	15	Corn grain/sugar-molasses	1.5
237	15	Corn/pop	1
238	15	Corn/sweet	1
291	O	Cottonseed-meal	1
290	O	Cottonseed-oil	1
55	11	Crabapples	1
8	O	Cranberries	1
9	O	Cranberries-juice	1.1
389	O	Cranberries-juice-concentrate	3.3
144	9A	Crenshaws	1
180	4A	Cress-garden/field	1
191	4A	Cress-upland	1
148	9B	Cucumbers	1
122	19B	Cumin	1
10	13B	Currants	1

APPENDIX D (CONT'D)

RAC Code	Crop Group	Commodity	Adjustment # 1
177	4A	Dandelion-greens	1
77	O	Dates	1
3	13A	Dewberries	1
123	19A	Dill	1
154	8	Eggplant	1
364	P	Eggs-white only	1
363	P	Eggs-whole	1
365	P	Eggs-yolk only	1
11	13B	Elderberries	1
178	4A	Endive-curley and escarole	1
179	19B	Fennel	1
390	O	Fern shoots (fiddleheads)	1
78	O	Figs	1
44	14	Filberts (hazelnuts)	1
352	F	Fish-finfish/freshwater	1
354	F	Fish-finfish-saltwater-dried	1.6
353	F	Fish-finfish/saltwater (incl.	1
351	F	Fish-roe/caviar	1
349	F	Fish-shellfish	1
292	O	Flax seed	1
202	3	Garlic	1
317	O	Gelatin	1
109	O	Genip (spanish lime)	1
124	1CD	Ginger	1
99	O	Ginkgo nuts	1
450	1AB	Ginseng	1
330	M	Goat-fat w/o bone	1
331	M	Goat-kidney	1
333	M	Goat-lean (fat/free) w/o bone	1
332	M	Goat-liver	1
328	M	Goat-meat byproducts	1
329	M	Goat-other organ meats	1
12	13B	Gooseberries	1
23	10	Grapefruit-juice	2.1
441	10	Grapefruit-juice-concentrate	8.26
448	10	Grapefruit peel	1
22	10	Grapefruit-peeled fruit	1
13	O	Grapes	1
15	O	Grapes-juice	1.2
392	O	Grapes-juice-concentrate	3.6
195	O	Grapes-leaves	1
14	O	Grapes-raisins	4.3
315	O	Grapes-wine and sherry	1
164	8	Groundcherries	1
287	6C	Guar beans	1
393	O	Guava-juice	1
79	O	Guava	1
897	O	Gums/gels	1

APPENDIX D (CONT'D)

RAC Code	Crop Group	Commodity	Adjustment # 1
45	14	Hickory nuts	1
281	O	Honey	1
125	O	Hops	1
334	M	Horsemeat	1
126	1AB	Horseradish	1
16	13B	Huckleberries	1
394	O	Jackfruit	1
395	O	Jobo	1
18	O	Juneberry	1
891	O	Jute	1
174	5B	Kale	1
97	O	Kiwi fruit	1
175	5A	Kohlrabi	1
24	10	Kumquats	1
193	O	Lambsquarter	1
894	O	Leavening agents	1
485	O	Leaves (misc)	1
204	3	Leeks	1
28	10	Lemons-juice	2
442	10	Lemons-juice-concentrate	11.4
27	10	Lemons-peel	1
26	10	Lemons-peeled fruit	1
243	6C	Lentils	1
182	4A	Lettuce-unspecified	1
176	4A	Lettuce-leafy varieties	1
192	4A	Lettuce-head varieties	1
32	10	Limes-juice	2
443	10	Limes-juice-concentrate	6
31	10	Limes-peel	1
30	10	Limes-peeled fruit	1
4	13A	Loganberries	1
108	O	Longan fruit	1
81	11	Loquats	1
396	O	Lotus root	1
96	O	Lychee-dried	1.85
95	O	Lychees (litchi)/fresh	1
46	14	Macadamia nuts (bush nuts)	1
132	19B	Mace	1
100	O	Maney (mammee apple)	1
80	O	Mangoes	1
285	O	Maple sugar	1
128	19A	Marjoram	1
350	O	Meat-game	1
141	9A	Melons-cantaloupes-juice	1
142	9A	Melons-cantaloupes-pulp	1
145	9A	Melons-honeydew	1
146	9A	Melons-persian	1
398	D	Milk-based water	1

APPENDIX D (CONT'D)

RAC Code	Crop Group	Commodity	Adjustment # 1
319	D	Milk-fat solids	1
318	D	Milk-nonfat solids	1
320	D	Milk sugar (lactose)	1
280	15	Millet	1
890	O	Miscellaneous/nfs	1
911	O	Molasses-nfs	1
19	O	Mulberries	1
244	6C	Mung beans (sprouts)	1
261	O	Mushrooms	1
183	5B	Mustard greens	1
130	19B	Mustard seed	1
64	12	Nectarines	1
496	O	Nopales	1
131	19B	Nutmeg	1
399	15	Oats-bran	1
269	15	Oats	1
245	O	Okra	1
397	9B	Okra/chinese (luffa)	1
82	O	Olives	1
300	O	Olive oil	1
206	3	Onions-dehydrated or dried	9
205	3	Onions-dry-bulb (cipollini)	1
262	3	Onions-green	1
36	10	Oranges-juice	1.8
33	10	Oranges-juice-concentrate	6.7
35	10	Oranges-peel	1
34	10	Oranges-peeled fruit	1
129	19A	Oregano	1
196	O	Oriental vegetables/leafy	1
308	O	Oriental vegetables/non-leafy	1
400	O	Palm hearts	1
302	O	Palm oil	1
85	O	Papayas-dried	1.8
86	O	Papayas-juice	1.5
84	O	Papayas-pulp	1
139	8	Paprika	1
184	4A	Parsley	1
225	1AB	Parsley roots	1
220	1AB	Parsnips	1
401	O	Passion fruit-juice	1
92	O	Passion fruit (granadilla)	1
87	O	Pawpaws	1
65	12	Peaches	1
66	12	Peaches-dried	7
402	12	Peaches-juice	1
403	O	Peanuts-butter	1.89
940	O	Peanuts-hulled	1
293	O	Peanuts-oil	1

APPENDIX D (CONT'D)

RAC Code	Crop Group	Commodity	Adjustment # 1
56	11	Pears	1
57	11	Pears-dried	6.25
404	11	Pears-juice	1
240	6C	Peas (garden)-dry	1
241	6AB	Peas (garden)-green	1
405	6B	Peas-succulent/blackeye/cowpea	1
47	14	Pecans	1
381	19B	Pepper/black	1
310	O	Peppermint	1
311	O	Peppermint-oil	1
156	8	Peppers-chilli incl jalapeno	1
157	8	Peppers-other	1
155	8	Peppers-sweet(garden)	1
88	O	Persimmons	1
158	8	Pimientos	1
90	O	Pineapples-dried	5
91	O	Pineapples-juice	1.7
406	O	Pineapples-juice-concentrate	6.3
89	O	Pineapples-peeled fruit	1
254	O	Pinenuts	1
50	O	Pistachio nuts	1
101	O	Pitanga (surinam cherry)	1
480	O	Plantains-green	1
94	O	Plantains-ripe	1
481	O	Plantains-dried	3.9
67	12	Plums (damsons)	1
68	12	Plums-prunes (dried)	5
69	12	Plums/prune-juice	1.4
263	O	Poke greens	1
93	O	Pomegranates	1
140	19B	Poppy	1
344	M	Pork-fat w/o bone	1
345	M	Pork-kidney	1
347	M	Pork-lean (fat free) w/o bone	1
346	M	Pork-liver	1
342	M	Pork-meat byproducts	1
343	M	Pork-other organ meats	1
210	1C	Potatoes/white-dry	6.5
209	1C	Potatoes/white-peeled	1
211	1C	Potatoes/white-peel only	1
208	1C	Potatoes/white-unspecified	1
207	1C	Potatoes/white-whole	1
362	P	Poultry-other-fat w/o bones	1
361	P	Poultry-other-giblets(liver)	1
360	P	Poultry-other-lean (fat free)	1
895	O	Psyllium	1
149	9B	Pumpkin	1
58	11	Quinces	1

APPENDIX D (CONT'D)

RAC Code	Crop Group	Commodity	Adjustment # 1
335	M	Rabbit	1
492	O	Radicchio	1
407	1AB	Radishes-japanese (daiken)	1
484	O	Radishes-oriental	1
212	1AB	Radishes-roots	1
213	2	Radishes-tops	1
5	13A	Raspberries	1
185	4B	Rhubarb	1
408	15	Rice-bran	1
271	15	Rice-milled (white)	1
270	15	Rice-rough (brown)	1
409	15	Rice-wild	1
127	19A	Rosemary	1
214	1AB	Rutabagas-roots	1
215	2	Rutabagas-tops	1
274	15	Rye-flour	1
273	15	Rye-germ	1
272	15	Rye-rough	1
295	O	Safflower-oil	1
294	O	Safflower-seed	1
494	O	Saffron	1
133	19A	Sage	1
216	1AB	Salsify(oyster plant)	1
893	O	Salt	1
473	O	Sapodilla	1
134	19A	Savory	1
460	O	Seafood-misc(turtle/frog)	1
411	O	Seaweed	1
309	O	Seeds (misc.)	1
412	O	Sequin (portuguese squash)	1
252	O	Sesame seeds	1
296	O	Sesame-oil	1
217	3	Shallots	1
338	M	Sheep-fat w/o bone	1
339	M	Sheep-kidney	1
341	M	Sheep-lean (fat free) w/o bone	1
340	M	Sheep-liver	1
336	M	Sheep-meat byproducts	1
337	M	Sheep-other organ meats	1
413	6A	Snowpeas	1
275	15	Sorghum (including milo)	1
102	O	Soursop (annona muricata)	1
414	O	Soursop-juice	1
303	6A	Soybean-other	1
307	6A	Soybeans-flour (defatted)	1
306	6A	Soybeans-flour (low fat)	1
305	6A	Soybeans-flour (full fat)	1
304	6A	Soybeans-mature seeds dry	1

APPENDIX D (CONT'D)

RAC Code	Crop Group	Commodity	Adjustment # 1
297	6A	Soybeans-oil	1
482	O	Soybeans-protein isolate	1
255	6A	Soybeans-sprouted seeds	0.33
312	O	Spearmint	1
313	O	Spearmint-oil	1
186	4A	Spinach	1
150	9B	Squash-summer	1
415	9B	Squash-spaghetti	1
151	9B	Squash-winter	1
17	O	Strawberries	1
416	O	Strawberries-juice	1
282	1A	Sugar-beet	1
379	1A	Sugar-beet-molasses	1
283	O	Sugar-cane	1
284	O	Sugar-cane/molasses	1
103	O	Sugar apples (sweetsop)	1
298	O	Sunflower-oil	1
417	O	Sunflower-seeds	1
218	1CD	Sweet potatoes (incl yams)	1
418	2	Sweet potatos-leaves	1
896	O	Sweeteners-artificial	1
187	4A	Swiss chard	1
419	O	Tamarind	1
37	10	Tangelos	1
38	10	Tangerines	1
39	10	Tangerines-juice	2.3
420	10	Tangerines-juice-concentrate	7.35
201	1CD	Taro-root	1
190	2	Taro-greens	1
493	O	Tarragon	1
113	O	Tea	1
422	O	Thistle leaves	1
136	19A	Thyme	1
163	8	Tomatoes-catsup	2.5
423	8	Tomatoes-dried	14.3
160	8	Tomatoes-juice	1.5
162	8	Tomatoes-paste	5.4
161	8	Tomatoes-puree	3.3
159	8	Tomatoes-whole	1
153	O	Towelgourd	1
355	P	Turkey-byproducts	1
357	P	Turkey--fat w/o bones	1
356	P	Turkey-giblets (liver)	1
358	P	Turkey- lean/fat free w/o bone	1
449	P	Turkey-other organ meats	1
137	1CD	Turmeric	1
219	1AB	Turnips-roots	1
188	2	Turnips-tops	1

APPENDIX D (CONT'D)

RAC Code	Crop Group	Commodity	Adjustment # 1
489	O	Vanilla	1
429	M	Veal-dried	1.92
424	M	Veal-fat w/o bones	1
426	M	Veal-kidney	1
425	M	Veal-lean (fat free) w/o bones	1
427	M	Veal-liver	1
430	M	Veal-meat byproducts	1
428	M	Veal-other organ meats	1
314	O	Vinegar	1
431	14	Walnut oil	1
48	14	Walnuts	1
226	O	Water chestnuts	1
432	O	Water-bottled	1
434	O	Water-commercial processing	1
435	O	Water-non-food based	1
433	O	Water-tap	1
189	O	Watercress	1
147	9A	Watermelon	1
436	9A	Watermelon-juice	1
278	15	Wheat-bran	1
279	15	Wheat-flour	1
277	15	Wheat-germ	1
437	15	Wheat-germ oil	1
276	15	Wheat-rough	1
438	O	Wi-apple	1
439	9B	Wintermelon	1
221	1CD	Yambean tuber (jicama)	1
224	1CD	Yautia (tannier)	1
440	O	Yeast	1
6	13A	Youngberries	1

APPENDIX E

MONTE CARLO ANALYSES AND DATA ENTRY SIMPLIFICATION

APPENDIX E

MONTE CARLO ANALYSES AND DATA ENTRY SIMPLIFICATION

HELPFUL INFORMATION REGARDING ACUTE DISTRIBUTIONAL ANALYSES AND THE MONTE CARLO OPTION

- What is the appropriate number of iterations?

  The number of iterations depends on the variability and number of observations in the residue data as well as on the number of foods being analyzed. The larger the variability and the larger the number of observations, the greater the number of iterations. From our own experience, it does not appear as if much is gained by utilizing more than 500 iterations, as long as the number of residue values (including zeroes) is bellow 500.

- What is a sufficient number of residue samples?

  The minimum number of residue samples depends on the application/distribution/level of precision desired. Generally, there is no minimum for Monte Carlo procedures; however, you will want to determine that the residue data are representative of the desired universe and that there are sufficient samples for this purpose.

- How is the frequency distribution generated?

  The program does not divide the residue distribution into bins. It does, however, divide the exposure range into bins that are equally spaced in the log-scale. The width of the intervals in log-scale is 1/7, which, in the scale of the original observations, means that the ratio of the upper limit of the bin to its lower limit is 1.15 (=exp(1/7)). Thus, the width of the intervals is 15% their lower limits. Thus, the bins are wider at the higher exposure values.

  Because the intervals increase in size, it is more likely to have a more even distribution of the number of observations in each interval in the case of skewed distributions (i.e., with a long tail).

  No parametric assumption are made about the distributions. But, the method used to create the intervals usually is used for skewed distributions such as the log-normal distributions.

APPENDIX E (CONT'D)

- Discussion of the uncertainties inherent in the program.

  DEEM™ ACUTE MODULE and MONTE CARLO assume the same basic underlying mode, namely that the exposure random variable (E) is the product of the consumption (C) and residue (R) random variables (E=CxR), and that C and R are statistically independent. In other words, the amount consumed is not related to the amount of residue in/on the food. The programs differ in the assumption of the residue distribution, i.e., the use of the residue distribution, or the derivation of the exposure distribution. Thus, the uncertainty in the programs can come from two sources:

  1. Uncertainty of the model: The model assumes that dietary exposure is the product of the amount consumed and the residue concentration in the foods. The model does not take into consideration individual differences that may exist in absorption, or the correlation, if any, between amounts of foods consumed and residue concentrations, or between the consumption levels of various members of the same household, or the consumption levels on the three days of the survey. (Note that the CSFII for 1994 through 1996 collected data for only two days. Data were collected 3 to 10 days apart to ensure that nutrient intakes on the 2 days would be statistically uncorrelated and 10 days was chosen as the maximum limit of endurance for interviewer-respondent rapport.)

  2. Uncertainty in the residue/consumption data: The uncertainty is related to such factors as whether the consumption data used in the assessment are truly representative of the usual food consumption of the various individuals in the population, and whether the residue data are representative of the residue concentrations in the foods. Another source of uncertainty in the data relates to the uncertainty in the data about foods as eaten to amounts of raw agricultural commodities.

     The variability between individual records with respect to the amounts of food consumed and the variability in the residue distribution determine the variability in the residue distribution and determine the variability in the exposure distribution. This variability can be assessed through the estimate of the standard deviation, and the percentiles of the exposure distribution.

APPENDIX E (CONT'D)

- Can the Monte Carlo option be modified to include the residue building program as opposed to having the build the files outside the program?

  Given the sheer magnitude of the number of residue values that could be used with these applications, this may not be recommended. It may be more useful if NOVIGEN develops a bridge between a designated "spreadsheet" program so that the values can be readily imported.

- Weighted data and DEEM™ Acute Module: Can unweighted data also be provided?

  Given the survey design, the statistical weights should always be used with the CSFII data.

- Monte Carlo and Adjustment Factors:

  Adjustment factor #1 is always used by the program. The user has the option of selecting adjustment factor #2; if this is chose, the program will multiply all residue values by both adjustment factors, even those in the RDF files. Typically, factor #2 should not be used in an acute analysis (since RDF files contain zero values to account for percent crop treated).

SHORT CUTS TO DATA ENTRY OF RDF FILES

RDF files contain residue data for a particular chemical that are representative of the distribution of residue levels found in particular foods. The DEEM™, FARE™, and CALENDEX™ programs running in the Monte Carlo analysis mode draw residue values at random from this file for use in an exposure analysis of that food. RDF files are generated using a text editor or word processor, or automatically using RDFgen™. RDF files must always be saved as ASCII (DOS) text files (i.e., no coded characters in the file).

The first four lines in the RDF file are reserved for documentation and key words only. Do NOT place residue values other than those included with keywords in the first four lines. (This is to maintain consistency with an older file format.)

RDF files can have an unlimited number of documentation lines at the top but all documentation lines must start with the word "doc" (case insensitive) or an apostrphe, e.g.:

doc this is documentation
or
' this is documentation.

There are five keywords to describe the content of a RDF file. The key words must be on separate lines (except LODRES). Do not place other documentation or comments on these lines. Do not use a keyword more than once in a RDF file.

APPENDIX E (CONT'D)

Key words:

TOTALNZ = xxx (total number of non-zero residues that are included in the file, one to a line, not including residues that are designated with frequencies or LODRES.

TOTALZ = xxx (total number of zeros residues to be included as a block in the analysis, not including any zeros which are entered as stand-alone residues or with frequencies.

TOTALLOD = xxx (total number of limit-of-detection residue values entered as a single block; must be followed by "LODRES = xxx" which is the limit-of-detection residue amount.

TOTALFREQ = xxx (total number of residue entries that are preceded by a frequency, which indicates how many times that residue amount appears in the original residue data. Frequency-residue pairs must be separated by a comma and only one pair can be entered on a line; e.g., 5,0.1 means that the residue value 0.1 appears 5 times in the original residue data.

Note: TOTALNZ and TOTALFREQ are optional; the program will count occurrences of each type and assign the sum to each variable type; however, use of these key words provides a means of cross checking your data (the counted sums will be matched to their respective declarations).

Note: The total number of residues in any given RDF file, including each residue multiplied by its frequency and summed, cannot exceed 32,767. (A check is made on this.) This does not include TOTALZ or TOTALLOD, which can be any size.

There is no required order for residues entered alone or with frequencies. That is, they can be in mixed order as long as there is not more than one residue value or frequency-residue pair on any line. The comma is the character that the program uses to differentiate between the two types of entries.

APPENDIX E (CONT'D)

RDF example 1:

```
----------
doc this is a documentation line
TOTALNZ = 5
TOTALZ = 10
TOTALFREQ = 5

1
3, 2
3
2, 4
5
4, 6
7
2, 8
9
2, 10
----------
```

Mixing allows residues to be included in numeric order, but this is not required. There are a total of 18 residues in this file, not counting the 10 zeros.

RDF example 2:

```
----------
TOTALNZ = 5
TOTALZ = 10
TOTALLOD = 5
LODRES = .123
1
3
5
6
7
----------
```

This file includes 5 LOD residue observations (.123) plus 5 non-zero residue values, plus 10 zeros values.

APPENDIX E (CONT'D)

RDF example 3:

```
----------
TOTALNZ = 18
TOTALZ = 10
1
2
2
2
3
4
4
5
6
6
6
6
7
8
8
9
10
10
----------
```

Note that four lines are reserved at top before residue values are shown.

This example is equivalent to example 1. However, you will not get exactly the same results as it you run with example 1 because the data are not processed in the same order. When you use freq data the freq data are processed first; then the single residues are processed; the random number sequence as applied to the individual residues is thus different.

See example 4 to see the equivalent RDF file that will give identical results to example 1 when the same seed is used and the program is started fresh.

APPENDIX E (CONT'D)

RDF example 4:

```
----------
TOTALNZ = 18
TOTALZ = 10

                    Must leave four lines at top before residue entries.
2
2
2
4                   This example will give exactly the same results
4                   as example 1 when used with the same seed.
6
6
6
6
8
8
10
10
1
3
5
7
9
----------
```

If adjusting for percent of the crop treated, instead of "augmenting" the data file by entering the appropriate number of zeroes, simply tell the program the number of zeroes by using

TOTALZ = XX

NOTE: This feature is not case sensitive: the number of zeros will be dependent on the number of residue values in the RDF file (i.e., the maximum number cannot exceed 32,767).

The limit of detection or a fraction of it, can be included by specifying the number of samples at the LOD and the LOD value as follows:

TOTALLOD = XXX
LODRES = XXX.XXXX

APPENDIX E (CONT'D)

NOTE: the unit for the LOD residue value must be the same as the others in the file (i.e., ppm).

As a check, the number of positive residue values in the RDF file may be provided as follows:

TOTALNZ = XXX

NOTE: This feature is not case sensitive; the number of values will depend on the total number of residue values in the RDF file (i.e., the maximum number cannot exceed 32,000). Even though TOTALNZ stands for "non-zero," any zero value in the file will be counted as a valid residue value and used in the analysis in addition to the zeroes brought in by the TOTALZ declaration.

RDF files may contain documentation information in any line that contains a code word OR residue value. This documentation is in addition to any included in the first four lines of the file. Any documentation listed outside the first four lines MUST begin with a non-numeric character or code word (e.g., "doc") that follows the code word information or the residue value. Note that a blank space by itself is not sufficient to initiate a documentation statement. Thus, a residue value followed by a blank space and then a numeric character will cause an error when reading the line.

Example:

TOTALZ=10 doc this is documentation
10, 0.001 doc this is documentation
0.01 this is documentation

but not:
TOTALZ = 10 10 is from source xyz (this will result in the 10 being interpreted by the program as 1000)

APPENDIX F

FOOD DEFINITIONS

APPENDIX F

FOOD DEFINITIONS

Ingredient Code	Crop Group	
98	O	Acerola
316	O	Alcohol-distilled
248	O	Alfalfa sprouts
138	19B	Allspice
40	14	Almonds
376	O	Aloe vera-juice
498	4A	Amaranth
115	19B	Anise
52	11	Apples
53	11	Apples-dried
54	11	Apples-juice/cider
377	11	Apples-juice-concentrate
410	12	Apricot juice
59	12	Apricots
60	12	Apricots-dried
181	O	Artichokes-globe
203	1CD	Artichokes-jerusalem
491	O	Arugula
260	O	Asparagus
70	O	Avocados
497	9B	Balsam pear
264	O	Bamboo shoots
72	O	Bananas
73	O	Bananas-dried
378	O	Bananas-juice
265	15	Barley
116	19A	Basil
135	19A	Bay
258	6C	Beans-dry-blackeye peas/cowpea
249	6C	Beans-dry-broadbeans
259	6C	Beans-dry-garbanzo/chick pea
227	6C	Beans-dry-great northern
256	6C	Beans-dry-hyacinth
228	6C	Beans-dry-kidney
229	6C	Beans-dry-lima
230	6C	Beans-dry-navy (pea)
231	6C	Beans-dry-other
251	6C	Beans-dry-pigeon beans
232	6C	Beans-dry-pinto
250	6B	Beans-succulent-broadbeans
234	6A	Beans-succulent-green
257	6	Beans-succulent-hyacinth
233	6B	Beans-succulent-lima
235	6A	Beans-succulent-other
236	6A	Beans-succulent-yellow/wax

APPENDIX F (CONT'D)

Ingredient Code	Crop Group		
253	6	Beans-unspecified	
51	14	Beechnuts	
323	M	Beef-dried	
324	M	Beef-fat w/o bones	
325	M	Beef-kidney	
327	M	Beef-lean (fat/free) w/o bones	
326	M	Beef-liver	
321	M	Beef-meat byproducts	
322	M	Beef-other organ meats	
950	O	Beer	Includes rice, hops, barley (do not include hops and beer in same residue file)
197	1AB	Beets-garden-roots	
165	2	Beets-garden-tops(greens)	
152	9B	Bitter melon	
1	13A	Blackberries	
380	13A	Blackberries-juice	
7	13B	Blueberries	
452	5B	Bok choy	
2	13A	Boysenberries	
41	14	Brazil nuts	
104	O	Bread fruit	
105	O	Bread nuts	
168	5A	Broccoli	
451	5A	Broccoli-chinese	
169	5A	Brussels sprouts	
286	15	Buckwheat	
382	1AB	Burdock	
49	14	Butter nuts	
170	5A	Cabbage-green and red	
383	5B	Cabbage-savoy	
194	O	Cactus pads (nopal)	
301	O	Canola oil (rape seed oil)	
106	O	Carambola (starfruit)	
117	19B	Caraway	
247	O	Carob	
198	1AB	Carrots	
143	9A	Casabas	
42	14	Cashews	
222	1CD	Cassava (yuca blanca)	
118	19B	Cassia	
288	O	Castor beans	
171	5A	Cauliflower	
199	1AB	Celeriac	
166	4B	Celery	
384	4B	Celery juice	
467	19B	Celery seed	
483	O	Chayote	
107	O	Cherimoya	

APPENDIX F (CONT'D)

Ingredient Code	Crop Group		
61	12	Cherries	
62	12	Cherries-dried	
63	12	Cherries-juice	
447	4A	Chervil	
43	14	Chestnuts	
366	P	Chicken-byproducts	
368	P	Chicken-fat w/o bones	
367	P	Chicken-giblets(liver)	
385	P	Chicken-giblets (excl. liver)	
369	P	Chicken-lean/fat free w/o bones	
114	1AB	Chicory	root vegetable
167	4A	Chicory(french/belgian endive)	leafy vegetable
200	19A	Chives	
111	O	Chocolate	
110	O	Chocolate-cocoa butter	
386	9B	Christophine	
892	O	Chrysanthemum	
495	O	Cilantro	
119	19B	Cinnamon	
20	10	Citrus citron	
120	19B	Clove	
75	O	Coconut-dried (copra)	
387	O	Coconut-milk	
299	O	Coconut-oil	
76	O	Coconut-water	
74	O	Coconut	
112	O	Coffee	
172	5B	Collards	
121	19B	Coriander	
267	15	Corn grain-bran	outer hull of the corn kernel
266	15	Corn grain-endosperm	corn kernel excluding hull, bran and germ
289	15	Corn grain-oil	
268	15	Corn grain/sugar/hfcs	
388	15	Corn grain/sugar-molasses	
237	15	Corn/pop	
238	15	Corn/sweet	
291	O	Cottonseed-meal	
290	O	Cottonseed-oil	
55	11	Crabapples	
8	O	Cranberries	
9	O	Cranberries-juice	
389	O	Cranberries-juice-concentrate	
144	9A	Crenshaws	
180	4A	Cress-garden/field	
191	4A	Cress-upland	
148	9B	Cucumbers	
122	19B	Cumin	
10	13B	Currants	

APPENDIX F (CONT'D)

Ingredient Code	Crop Group	
177	4A	Dandelion-greens
77	O	Dates
3	13A	Dewberries
123	19A	Dill
154	8	Eggplant
364	P	Eggs-white only
363	P	Eggs-whole
365	P	Eggs-yolk only
11	13B	Elderberries
178	4A	Endive-curley and escarole
179	19B	Fennel
390	O	Fern shoots (fiddleheads)
78	O	Figs
44	14	Filberts (hazelnuts)
352	F	Fish-finfish/freshwater
354	F	Fish-finfish-saltwater-dried
353	F	Fish-finfish/saltwater (incl. Tuna)
351	F	Fish-roe/caviar
349	F	Fish-shellfish
292	O	Flax seed
202	3	Garlic
317	O	Gelatin
109	O	Genip (spanish lime)
124	1CD	Ginger
99	O	Ginkgo nuts
450	1AB	Ginseng
330	M	Goat-fat w/o bone
331	M	Goat-kidney
333	M	Goat-lean (fat/free) w/o bone
332	M	Goat-liver
328	M	Goat-meat byproducts
329	M	Goat-other organ meats
12	13B	Gooseberries
23	10	Grapefruit-juice
441	10	Grapefruit-juice-concentrate
448	10	Grapefruit peel
22	10	Grapefruit-peeled fruit
13	O	Grapes
15	O	Grapes-juice
392	O	Grapes-juice-concentrate
195	O	Grapes-leaves
14	O	Grapes-raisins
315	O	Grapes-wine and sherry
164	8	Groundcherries
287	6C	Guar beans
393	O	Guava-juice
79	O	Guava
45	14	Hickory nuts

APPENDIX F (CONT'D)

Ingredient Code	Crop Group		
897	O	Gums/gels	Carboxy-methyl cellulose, gums, stabilizers, etc.
281	O	Honey	
125	O	Hops	
334	M	Horsemeat	
126	1AB	Horseradish	
16	13B	Huckleberries	
394	O	Jackfruit	
395	O	Jobo	
18	O	Juneberry	
891	O	Jute	
174	5B	Kale	
97	O	Kiwi fruit	
175	5A	Kohlrabi	
24	10	Kumquats	
193	O	Lambsquarter	
894	O	Leavening agents	Baking soda, powder
485	O	Leaves (misc)	Includes those without their own category
204	3	Leeks	
28	10	Lemons-juice	
442	10	Lemons-juice-concentrate	
27	10	Lemons-peel	
26	10	Lemons-peeled fruit	
243	6C	Lentils	
182	4A	Lettuce-unspecified	
176	4A	Lettuce-leafy varieties	
192	4A	Lettuce-head varieties	
32	10	Limes-juice	
443	10	Limes-juice-concentrate	
31	10	Limes-peel	
30	10	Limes-peeled fruit	
4	13A	Loganberries	
108	O	Longan fruit	
81	11	Loquats	
396	O	Lotus root	
96	O	Lychee-dried	
95	O	Lychees (litchi)/fresh	
46	14	Macadamia nuts (bush nuts)	
132	19B	Mace	
100	O	Maney (mammee apple)	
80	O	Mangoes	
285	O	Maple sugar	Sugar made from sugar maple (*Acer saccharum*)
128	19A	Marjoram	
350	O	Meat-game	
141	9A	Melons-cantaloupes-juice	
142	9A	Melons-cantaloupes-pulp	
145	9A	Melons-honeydew	
146	9A	Melons-persian	
398	D	Milk-based water	Water fraction of milk products

APPENDIX F (CONT'D)

Ingredient Code	Crop Group		
319	D	Milk-fat solids	
318	D	Milk-nonfat solids	Includes whey, other milk proteins
320	D	Milk sugar (lactose)	
280	15	Millet	
890	O	Miscellaneous/nfs	Includes flavors, colors, nutrients (added) and a variety of food additives that are listed on product label.
911	O	Molasses-nfs	Molasses other than cane sugar molasses, beet sugar molasses, or corn sugar molasses.
19	O	Mulberries	
244	6C	Mung beans (sprouts)	
261	O	Mushrooms	
183	5B	Mustard greens	
130	19B	Mustard seed	
64	12	Nectarines	
496	O	Nopales	
131	19B	Nutmeg	
399	15	Oats-bran	
269	15	Oats	
245	O	Okra	
397	9B	Okra/chinese (luffa)	
82	O	Olives	
300	O	Olive oil	
206	3	Onions-dehydrated or dried	
205	3	Onions-dry-bulb (cipollini)	
262	3	Onions-green	Includes spring onions
36	10	Oranges-juice	
33	10	Oranges-juice-concentrate	
35	10	Oranges-peel	
34	10	Oranges-peeled fruit	
129	19A	Oregano	
196	O	Oriental vegetables/leafy	
308	O	Oriental vegetables/non-leafy	
400	O	Palm hearts	
302	O	Palm oil	
85	O	Papayas-dried	
86	O	Papayas-juice	
84	O	Papayas-pulp	
139	8	Paprika	
184	4A	Parsley	
225	1AB	Parsley roots	
220	1AB	Parsnips	
401	O	Passion fruit-juice	
92	O	Passion fruit (granadilla)	
87	O	Pawpaws	
65	12	Peaches	
66	12	Peaches-dried	
402	12	Peaches-juice	

APPENDIX F (CONT'D)

Ingredient Code	Crop Group	
403	O	Peanuts-butter
940	O	Peanuts-hulled
293	O	Peanuts-oil
56	11	Pears
57	11	Pears-dried
404	11	Pears-juice
240	6C	Peas (garden)-dry
241	6AB	Peas (garden)-green
405	6B	Peas-succulent/blackeye/ cowpea
47	14	Pecans
381	19B	Pepper/black
310	O	Peppermint
311	O	Peppermint-oil
156	8	Peppers-chilli incl jalapeno
157	8	Peppers-other
155	8	Peppers-sweet(garden)
88	O	Persimmons
158	8	Pimientos
90	O	Pineapples-dried
91	O	Pineapples-juice
406	O	Pineapples-juice-concentrate
89	O	Pineapples-peeled fruit
254	O	Pinenuts
50	O	Pistachio nuts
101	O	Pitanga (surinam cherry)
480	O	Plantains-green
94	O	Plantains-ripe
481	O	Plantains-dried
67	12	Plums (damsons)
68	12	Plums-prunes (dried)
69	12	Plums/prune-juice
263	O	Poke greens
93	O	Pomegranates
140	19B	Poppy
344	M	Pork-fat w/o bone
345	M	Pork-kidney
347	M	Pork-lean (fat free) w/o bone
346	M	Pork-liver
342	M	Pork-meat byproducts
343	M	Pork-other organ meats
210	1C	Potatoes/white-dry
209	1C	Potatoes/white-peeled
211	1C	Potatoes/white-peel only
208	1C	Potatoes/white-unspecified
207	1C	Potatoes/white-whole
362	P	Poultry-other-fat w/o bones
361	P	Poultry-other-giblets(liver)
360	P	Poultry-other-lean (fat free) w/

APPENDIX F (CONT'D)

Ingredient Code	Crop Group		
895	O	Psyllium	
149	9B	Pumpkin	
58	11	Quinces	
335	M	Rabbit	
492	O	Radicchio	
407	1AB	Radishes-japanese (daiken)	
484	O	Radishes-oriental	
212	1AB	Radishes-roots	
213	2	Radishes-tops	
5	13A	Raspberries	
185	4B	Rhubarb	
408	15	Rice-bran	Layer beneath hull; contains outer bran and parts of the germ.
271	15	Rice-milled (white)	Rice kernels after milling is complete and hulls, bran, and germ are removed.
270	15	Rice-rough (brown)	Rice with hulls removed, but bran remaining
409	15	Rice-wild	
127	19A	Rosemary	
214	1AB	Rutabagas-roots	
215	2	Rutabagas-tops	
274	15	Rye-flour	
273	15	Rye-germ	Embryo or sprouting part of the grain.
272	15	Rye-rough	
295	O	Safflower-oil	
294	O	Safflower-seed	
494	O	Saffron	
133	19A	Sage	
216	1AB	Salsify(oyster plant)	
893	O	Salt	
473	O	Sapodilla	
134	19A	Savory	
460	O	Seafood-misc(turtle/frog)	
411	O	Seaweed	
309	O	Seeds (misc.)	Other than those identified as separate RACs (e.g., sesame seeds, sunflower seeds)
412	O	Sequin (portuguese squash)	
252	O	Sesame seeds	
296	O	Sesame-oil	
217	3	Shallots	
338	M	Sheep-fat w/o bone	
339	M	Sheep-kidney	
341	M	Sheep-lean (fat free) w/o bone	
340	M	Sheep-liver	
336	M	Sheep-meat byproducts	
337	M	Sheep-other organ meats	
413	6A	Snowpeas	
275	15	Sorghum (including milo)	
102	O	Soursop (annona muricata)	

APPENDIX F (CONT'D)

Ingredient Code	Crop Group	
414	O	Soursop-juice
303	6A	Soybean-other
307	6A	Soybeans-flour (defatted)
306	6A	Soybeans-flour (low fat)
305	6A	Soybeans-flour (full fat)
304	6A	Soybeans-mature seeds dry
297	6A	Soybeans-oil
482	O	Soybeans-protein isolate
255	6A	Soybeans-sprouted seeds
312	O	Spearmint
313	O	Spearmint-oil
186	4A	Spinach
150	9B	Squash-summer
415	9B	Squash-spaghetti
151	9B	Squash-winter
17	O	Strawberries
416	O	Strawberries-juice
282	1A	Sugar-beet
379	1A	Sugar-beet-molasses
283	O	Sugar-cane
284	O	Sugar-cane/molasses
103	O	Sugar apples (sweetsop)
298	O	Sunflower-oil
417	O	Sunflower-seeds
218	1CD	Sweet potatoes (incl yams)
418	2	Sweet potatos-leaves
896	O	Sweeteners-artificial
187	4A	Swiss chard
419	O	Tamarind
37	10	Tangelos
38	10	Tangerines
39	10	Tangerines-juice
420	10	Tangerines-juice-concentrate
201	1CD	Taro-root
190	2	Taro-greens
493	O	Tarragon
113	O	Tea
422	O	Thistle leaves
136	19A	Thyme
163	8	Tomatoes-catsup
423	8	Tomatoes-dried
160	8	Tomatoes-juice
162	8	Tomatoes-paste
161	8	Tomatoes-puree
159	8	Tomatoes-whole
153	O	Towelgourd
355	P	Turkey-byproducts
357	P	Turkey--fat w/o bones

APPENDIX F (CONT'D)

Ingredient Code	Crop Group		
356	P	Turkey-giblets (liver)	
358	P	Turkey- lean/fat free w/o bones	
449	P	Turkey-other organ meats	
137	1CD	Turmeric	
219	1AB	Turnips-roots	
188	2	Turnips-tops	
489	O	Vanilla	
429	M	Veal-dried	
424	M	Veal-fat w/o bones	
426	M	Veal-kidney	
425	M	Veal-lean (fat free) w/o bones	
427	M	Veal-liver	
430	M	Veal-meat byproducts	
428	M	Veal-other organ meats	
314	O	Vinegar	
431	14	Walnut oil	
48	14	Walnuts	
226	O	Water chestnuts	
432	O	Water-bottled	
434	O	Water-commercial processing	Water added during processing (e.g., water in canned vegetables, infant foods, etc.)
435	O	Water-non-food based	Tap water consumed as a separate beverage. Amount reported in response to survey question, "How many glasses of water do you drink in a day?"
433	O	Water-tap	Tap water added to foods during cooking/preparation (e.g., water added to rice in home-prepared dish)
189	O	Watercress	
147	9A	Watermelon	
436	9A	Watermelon-juice	
278	15	Wheat-bran	Coarse, outer layer of grain
279	15	Wheat-flour	Finely ground endosperm fraction of grain
277	15	Wheat-germ	Embryo or sprouting part of the grain
437	15	Wheat-germ oil	Oil fraction pressed from germ
276	15	Wheat-rough	Grain and bran
438	O	Wi-apple	
439	9B	Wintermelon	
221	1CD	Yambean tuber (jicama)	
224	1CD	Yautia (tannier)	
440	O	Yeast	
6	13A	Youngberries	